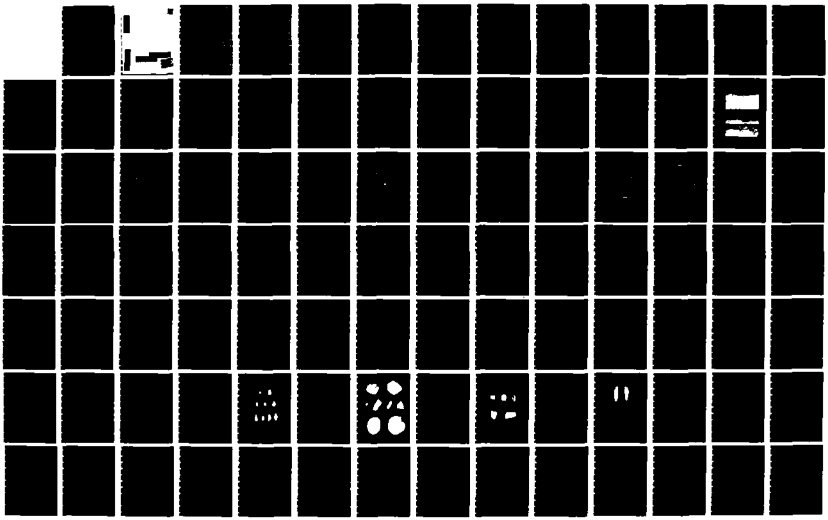
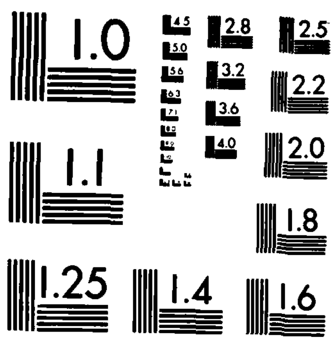
AD-A163 134 ARCHAEOLOGICAL INVESTIGATIONS AT SITE 45-DO-211 CHIEF JOSEPH DAM PROJECT WASHINGTON(U) WASHINGTON UNIV SEATTLE OFFICE OF PUBLIC ARCHAEOLOGY E D LOHSE ET AL 1984 DACW67-78-C-0106 1/2

UNCLASSIFIED F/G 5/6 NL





UNCLASSIFIED

SECURITY CLASSIFICATION OF THIS PAGE (When Data Entered)

10

REPORT DOCUMENTATION PAGE

READ INSTRUCTIONS BEFORE COMPLETING FORM

1. REPORT NUMBER

2. GOVT ACCESSION NO. AD-A163134

3. RECIPIENT'S CATALOG NUMBER

4. TITLE (and Subtitle)
Archaeological Investigations at Site 45-DO-211, Chief Joseph Dam Project, Washington.

5. TYPE OF REPORT & PERIOD COVERED
Final Technical Report
Aug 1978--Oct 1984

6. PERFORMING ORG. REPORT NUMBER

7. AUTHOR(s)
E.S. Lohse, with S.K. Campbell, L. Hause, S. Livingston, R.L. Lyman, and D. Sammons-Lohse

8. CONTRACT OR GRANT NUMBER(s)
DACW67-78-C-0106

9. PERFORMING ORGANIZATION NAME AND ADDRESS
Office of Public Archaeology,
Institute for Environmental Studies
University of Washington, Seattle WA 98195

10. PROGRAM ELEMENT, PROJECT, TASK AREA & WORK UNIT NUMBERS
BF285 18 08E U 0000

11. CONTROLLING OFFICE NAME AND ADDRESS
Planning Branch (NPSEN-PL-ER)
Seattle District, Corps of Engineers
P.O. Box C-3755, Seattle, WA 98124

12. REPORT DATE
1984

13. NUMBER OF PAGES
185

14. MONITORING AGENCY NAME & ADDRESS (if different from Controlling Office)

15. SECURITY CLASS. (of this report)
UNCLASSIFIED

15a. DECLASSIFICATION/DOWNGRADING SCHEDULE

16. DISTRIBUTION STATEMENT (of this Report)

Approved for public release, distribution unlimited

17. DISTRIBUTION STATEMENT (of the abstract entered in Block 20, if different from Report)

18. SUPPLEMENTARY NOTES

19. KEY WORDS (Continue on reverse side if necessary and identify by block number)

Cultural Resources, Washington
Columbia River Prehistory
Chief Joseph Dam Project Archaeology
Settlement and Subsistence Patterns
Housepits
Frenchman Springs Phase
Salmonids--Prehistory
Protohistoric Period

20. ABSTRACT (Continue on reverse side if necessary and identify by block number)

SEE REVERSE SIDE FOR COMMENTS

BLOCK 20 (Continued)

Site 45-DO-211 is on the south bank of the Columbia River about 340 m upstream from River Mile 589. Vegetation is characteristic of the Upper Sonoran life zone. The University of Washington excavated 88 m^3 (3.9 %) of site volume in 1979 for the U.S. Army Corps of Engineers, Seattle District, as part of a mitigation program associated with adding 10-ft to the operating pool level behind Chief Joseph Dam. A two-stage sampling design, incorporating random and non-random 1 x 1 x .01-m units of record, disclosed multiple episodes of prehistoric occupation spanning a period from ca. 5500-2700 B.P. and involving the construction of housepits as part of year-round activity. Four housepits were identified, with at least two of these evidently associated with a summer fish camp designed to take advantage of the seasonal runs of salmon. The others represent fall and winter occupations where economic emphasis was on the hunting of large ungulates. The documentation of a probable fishing camp with housepits in the Hudnut Phase (ca. 4000-2000 B.P.) at this site is unique in the Rufus Woods Lake project area, and suggests prehistoric economic systems over the last 3,000-4,000 years were generally similar to those described for the ethnohistoric period. The Columbia River was the focus of activity, with housepit settlements established at different points along the river.

ARCHAEOLOGICAL INVESTIGATIONS AT SITE 45-DO-211, CHIEF JOSEPH DAM PROJECT, WASHINGTON

by

Ernest D. Lohse

With

Sarah K. Campbell, L. Hause
Stephanie Livingston, R. Lee Lyman, Dorothy Sammons-Lohse

Principal Investigators

R.C. Dunnell 1978-1984
D.K. Grayson 1978-1981
M.E.W. Jaehnig 1981-1984
J.V.Jermann 1978-1981

Final report submitted to the U.S. Army Corps of Engineers, Seattle District, in partial fulfillment of the conditions and specifications of Contract No. DACW67-78-C-0106.

The technical findings and conclusions in this report do not necessarily reflect the views or concurrence of the sponsoring agency.

Office of Public Archaeology
Institute for Environmental Studies
University of Washington

1984

ABSTRACT

Site 45-DO-211 is on the south bank of the Columbia River about 340 m upstream from River Mile 589. Vegetation is characteristic of the Upper Sonoran life zone. The University of Washington excavated 88 m^3 (3.9 %) of site volume in 1979 for the U.S. Army Corps of Engineers, Seattle District, as part of a mitigation program associated with adding 10-ft to the operating pool level behind Chief Joseph Dam. A two-stage sampling design, incorporating random and non-random 1 x 1 x .01-m units of record, disclosed multiple episodes of prehistoric occupation spanning a period from ca. 5500-2700 B.P. and involving the construction of housepits as part of year-round activity. Four housepits were identified, with at least two of these evidently associated with a summer fish camp designed to take advantage of the seasonal runs of salmon. The others represent fall and winter occupations where economic emphasis was on the hunting of large ungulates. The documentation of a probable fishing camp with housepits in the Hudnut Phase (ca. 4000-2000 B.P.) at this site is unique in the Rufus Woods Lake project area, and suggests prehistoric economic systems over the last 3,000-4,000 years were generally similar to those described for the ethnohistoric period. The Columbia River was the focus of activity, with housepit settlements established at different points along the river.

TABLE OF CONTENTS

LIST OF FIGURES

LIST OF TABLES

LIST OF PLATES

ACKNOWLEDGEMENTS

This report is the result of the collaboration of many individuals and agencies. During the excavation and early reporting stages, Coprincipal Investigators were Drs. Robert C. Dunnell and Donald K. Grayson, both of the Department of Anthropology, University of Washington, and Dr. Jerry V. Jermann, Director of the Office of Public Archaeology, University of Washington. Dr. Manfred E.W. Jaehnig served as Project Supervisor during this stage of the work. Since the autumn of 1981, Dr. Jaehnig has served as Coprincipal Investigator with Dr. Dunnell.

Three Corps of Engineers staff members have made major contributions to the project. They are Dr. Steven F. Dice, Contracting Officer's Representative, and Corps archaeologists Lawr V. Salo and David A. Munsell. Both Mr. Munsell and Mr. Salo have worked to assure the success of the project from its initial organization through site selection, sampling, analysis, and report writing. Mr. Munsell provided guidance in the initial stages of the project and developed the strong ties with the Colville Confederated Tribes essential for the undertaking. Mr. Salo gave generously of his time to guide the project through data collection and analysis. In his review of each report, he exercises that rare skill, an ability to criticize constructively.

We have been fortunate in having the generous support and cooperation of the Colville Confederated Tribes throughout the entire length of project. The Tribes' Business Council and its History and Archaeology Office have been invaluable. We owe special thanks to Andy Joseph, former representative from the Nespelem District on the Business Council, and to Adeline Fredin, Tribal Historian and Director of the History and Archaeology Office. Mr. Joseph and the Business Council, and Mrs. Fredin, who acted as liaison between the Tribe and the project, did much to convince appropriate federal and state agencies of the necessity of the investigation. They helped secure land and services for the project's field facilities as well as helping establish a program which trained local people (including many tribal members) as field excavators and laboratory technicians. Beyond this, their hospitality has made our stay in the project area a most pleasant one. In return, conscious of how much gratitude we wish to convey in a few brief words, we extend our sincere thanks to all the members of the Colville Confederated Tribes who have supported our efforts, and to Mrs. Fredin and Mr. Joseph, in particular.

Site 45-DO-211 is located on property owned by Leroy J. Sanderson. We thank Mr. W.W. Wright, trustee for Mr. Sanderson, and Mr. Harold Tesch of Grand Coulee, the present occupant of the property, for permission to excavate.

As authors of this report, we take responsibility for its contents. What we have written here is only the final stage of a collaborative process which is analogous to the integrated community of people whose physical traces we have studied. Some, by dint of hard labor and archaeological training, salvaged those traces from the earth; others processed and analyzed those traces; some manipulated the data and some wrote, edited and produced this report. Each is a member of the community essential to the life of the work we have done.

Jerry V. Jermann, Coprincipal Investigator during the field excavation and artifact analysis phase of the project, developed site excavation sampling designs that were used to select data from each site. The designs provided a uniform context for studying prehistoric subsistence-settlement patterns in the project area.

Maureen King supervised the excavation of the site. S. Neal Crozier did the initial data summary for the stratigraphic analysis as well as the depositional unit analysis and the chemical and mechanical sort analyses. Denise Varner compiled the data for feature analysis and zone definitions. The laboratory staff, under the direction of Karen Whittlesey, did the technological and functional artifact analysis. Janice Jaehnig did keypunching and John Chapman and Duncan Mitchell manipulated the computerized data.

The writing of the report itself is a cooperative effort. Dr. Ernest S. Lohse wrote Chapters 1, 3, and 6; and with Sarah K. Campbell and L. Hause wrote Chapter 2. As senior author, he also coordinated and integrated the contributions of the other authors. Stephanie Livingston and R.L. Lyman analyzed the faunal assemblage and wrote Chapter 4. Dorothy Sammons-Lohse analysed the feature assemblage and wrote Chapter 5.

Linda Leeds and Marc Hudson edited the text, Dawn Brislawn and Natalie Cadoret prepared the report drafts. Fred Clark and James Bennett prepared working copy of many of the figures; Melodie Tune and Bob Radek drafted the final versions. Larry Bullis photographed the artifacts. Production of the final camera ready copy was accomplished by Natalie Cadoret and Karen Weed under the direction of Sarah K. Campbell.

PREFACE

The Chief Joseph Dam Cultural Resources Project (CJDCRP) has been sponsored by the Seattle District, U.S. Army Corps of Engineers (the Corps) in order to salvage and preserve the cultural resources imperiled by a 10 foot pool raise resulting from modifications to Chief Joseph Dam.

From Fall 1977 to Summer 1978, under contract to the Corps, the University of Washington, Office of Public Archaeology (OPA) undertook detailed reconnaissance and testing along the banks of Rufus Woods Lake in the Chief Joseph Dam project area (Contract No. DACW67-77-C-0099). The project area extends from Chief Joseph Dam at Columbia River Mile (RM) 545 upstream to RM 590, about seven miles below Grand Coulee Dam, and includes 2,015 hectares (4,979 acres) of land within the guide-taking lines for the expected pool raise. Twenty-nine cultural resource sites were identified during reconnaissance, bringing the total number of recorded prehistoric sites in the area to 279. Test excavations at 79 of these provided information about prehistoric cultural variability in this region upon which to base further resource management recommendations (Jermann et al. 1978; Leeds et al. 1981).

Only a short time was available for testing and mitigation before the planned pool raise. Therefore, in mid-December 1977, the Corps asked OPA to review the 27 sites tested to date and identify those worthy of immediate investigation. A priority list of six sites was compiled. The Corps, in consultation with the Washington State Historic Preservation Officer and the Advisory Council on Historic Preservation, established an interim Memorandum of Agreement under which full-scale excavations at those six sites could proceed. In August 1978, data recovery (Contract No. DACW67-78-C-0106) began at five of the six sites.

Concurrently, data from the 1977 and 1978 testing, as well as those from previous testing efforts (Osborne et al. 1952; Lyman 1976), were synthesized into a management plan recommending ways to minimize loss of significant resources. This document calls for excavations at 34 prehistoric habitation sites, including the six already selected (Jermann et al. 1978). The final Memorandum of Agreement includes 20 of these. Data recovery began in May 1979 and continued until late August 1980.

Full-scale excavation could be undertaken at only a limited number of sites. The testing program data allowed identification of sites in good condition that were directly threatened with inundation or severe erosion by the projected pool raise. To aid in selecting a representative sample of prehistoric habitation sites for excavation, site "components" defined during testing were characterized according to (1) probable age, (2) probable type of occupation, (3) general site topography, and (4) geographic location along the

river (Jermann et al. 1978:Table 18). Sites were selected to attain as wide a diversity as possible while keeping the total number of sites as low as possible.

The Project's investigations are documented in four report series. Reports describing archaeological reconnaissance and testing include (1) a management plan for cultural resources in the project area (Jermann et al. 1978), (2) a report of testing at 79 prehistoric habitation sites (Leeds et al. 1981), and (3) an inventory of data derived from testing. Series I of the mitigation reports includes (1) the project's research design (Campbell 1984d) and (2) a preliminary report (Jaehnig 1983b). Series II consists of 14 descriptive reports on prehistoric habitation sites excavated as part of the project (Campbell 1984b; Jaehnig 1983a, 1984a,b; Lohse 1984a-f; Miss 1984a-d), reports on prehistoric nonhabitation sites (Campbell 1984a) and burial relocation projects (Campbell 1984c), and a report on the survey and excavation of historic sites (Thomas et al. 1984). A summary of results is presented in Jaehnig and Campbell (1984).

This report is one of the Series II mitigation reports. Mitigation reports document the assumptions and contingencies under which data were collected, describe data collection and analysis, and organize and summarize data in a form useful to the widest possible archaeological audience.

1. INTRODUCTION

Site 45-DO-211 is on the south bank of the Columbia River about 340 m (1,115 ft) upstream from River Mile (RM) 589 in the SW 1/4 of the NE1/4 of the SW1/4 of Section 1, T29N, R30E (U.T.M. Zone 11, N.5,322,090, E.351,957) (Figure 1-1).

The site lies inside a bend of the Columbia River below steep cliffs (Figure 1-2). Away from the river, terrain rapidly steepens, rising to over 600 m (970 ft) above mean sea level (m.s.l.) in less than 2 km. Sanderson Creek is 100 m to the east; Rebeccca Lake 3 km to the northeast; Buffalo Lake about 7 km to the northeast; and McGinnis Lake about 7 km to the east. Sanderson Creek provided a natural corridor between the river and the uplands. The site lies on a long, low terrace that was about 40-50 m (131-164 ft) above the Columbia River before dam construction. At present, it is no more than 3-10 m (9.8-33 ft) above the reservoir. Steep draws bound the site on the north and south. The draw which roughly bisects the site area proper is a placer mining scar. The site was homesteaded in the mid-nineteenth to late-nineteenth century, when placer mining was also done. It has been used for grazing and associated activities throughout this century (cf., historic site 45-DO-210 in Thomas et al. 1984). A rich collection of historic artifacts, placer mining scars and a root cellar, document extensive disturbance of the uppermost prehistoric site deposit. Most of this disturbance was confined to the southern portion of the site, behind the primary prehistoric deposits and away from the river. The largest placer scar was used as a dump. Historic artifacts occurred only in the upper 30-50 cm of the site deposit. Plates 1-1 and 1-2 show two views of the site.

A sagebrush-grass association (*Artemisia tridentata-Agropyron*) (Daubenmire 1970), typical of the Upper Sonoran life zone (Piper 1906), characterizes the vegetation in the site area. Introduced plants include cheatgrass (*Bromus tectorum*), Russian thistle (*Salsola kali*), and thistle (*Cirsium* spp.) among others. Scattered sagebrush and rabbitbrush (*Chrysothamnus nauseosus*), and a dense understory of grasses along with an abundance of spring flowers grows on the site. A more mesic association including rose (*Rosa* sp.), serviceberry (*Amelanchier* sp.), horsetail (*Equisetum* spp.), tule (*Scirpus acutus*), and sedges (*Carex* spp.) grows in nearby drainages.

On the upper terraces above the river, *Artemisia rigida* replaces big sagebrush in areas of thinner, rocky soils. Bitterbrush (*Purshia tridentata*) and isolated pines (*Pinus ponderosa*), with an understory of grasses, grow along the steep draws draining the slopes and terraces. To the south, across the river, scattered pines give way to sagebrush covered uplands dotted with

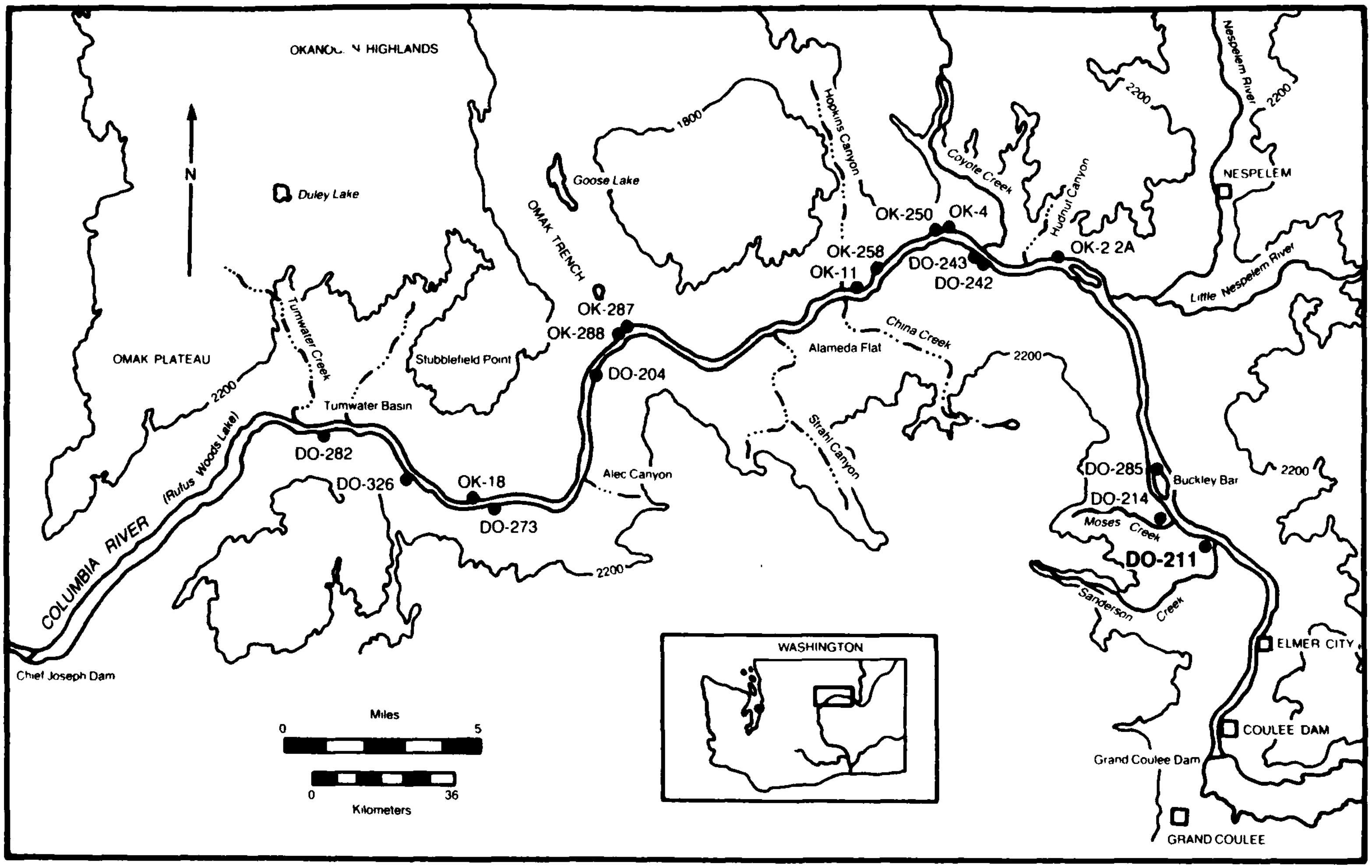


Figure 1-1. The Chief Joseph Dam Cultural Resources Project area.

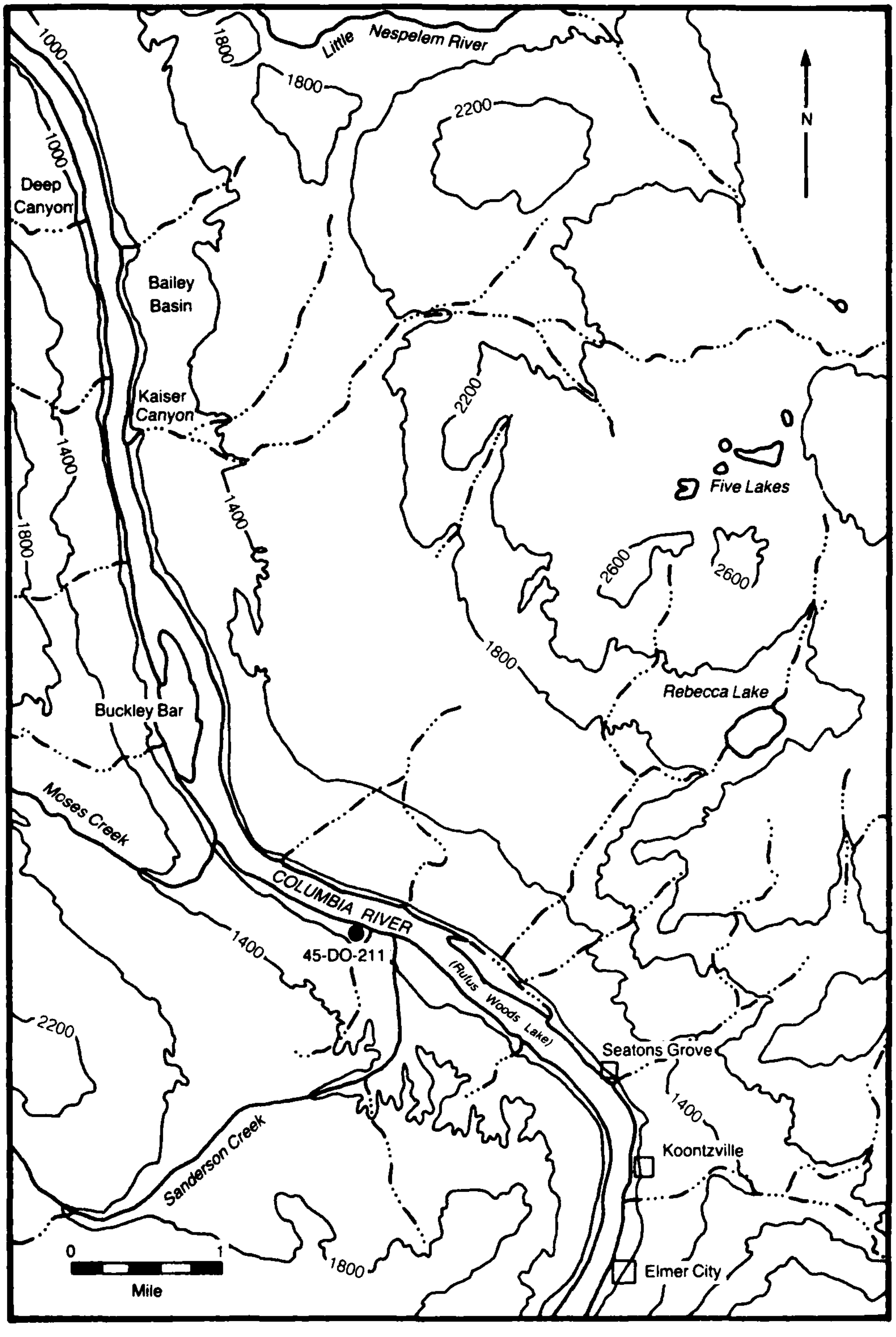


Figure 1-2. Map of site vicinity, 45-DO-211.

Plate 1-1. View to the south, 45-DO-211.

Plate 1-2. View to the northeast, 45-DO-211.

small lakes and springs. To the north, mixed Douglas fir (Pseudotsuga menziesii) and pine are dominant in moister bottomlands and along streams, where they grow with broadleaf trees and shrubs. At the highest elevations, the fir forest gives way to pine forest, except on north-facing slopes and valley floors, where the dominant species is still Douglas fir with larch (Larix occidentalis) and some spruce (Picea engelmannii) and an associated understory of woody shrubs.

A wide variety of riverine and terrestrial resources was available to the prehistoric occupants of 45-DO-211. Fresh water was nearby. From adjacent habitats, they could obtain a range of plant species ethnographic societies of the area used in the manufacture of utilitarian items--rushes and bark for matting and baskets, for instance. They could gather edible seeds and roots as well as brush for fuel. Driftwood from the river and the nearby stands of ponderosa provided a ready source of building material and fuel. Year-round, they could hunt small game such as beaver (Castor canadensis), hares (Lepus townsendii), and marmots (Marmota flaviventris), common residents of the general site area. Larger game were available in the winter, when mountain sheep and elk came down from the uplands to forage by the river. Deer were probably present year-round. The river, of course, yielded an abundance of fish: four species of salmon--chinook (Oncorhynchus tschawytscha), coho (O. kisutch), chum (O. keta), and humpback (O. gorbushcha)--ran from May through November; sturgeon (Acipenser transmontanus) ran in August. Resident fish species would have been available year-round. Waterfowl were present year-round, although during spring and fall migrations and during the breeding seasons in the late spring-early summer their numbers would have been at their peak.

INVESTIGATIONS AT 45-DO-211

Site 45-DO-211 was recorded as an open camp site in the USCE survey of 1976 (Munsell and Salo 1977). It was tested by the project in 1978. Two test units were placed north of the root cellar on the eastern portion of the site, (Figure 1-3), in areas where cultural materials were noted on the surface and disturbance due to placer mining was minimal. A third test pit was excavated in the area west of the draw to assess cultural materials in this area lying outside the boundaries of the site as defined in the original survey. The testing results indicated three well-defined components at the site. The middle component was of particular interest since it was judged to represent an open camp, a campsite without housepits, thought to be contemporary with Cayuse phase components in the Mid-Columbia region (cf., Nelson 1969; Galm et al. 1980). At the time of site selection, few other components of this type and age had been identified. Another factor in its selection was its extreme upstream location within the project area, in a locale where relatively few sites had been found to yield significant cultural remains.

Excavations at 45-DO-211 were carried out from 18 July to 30 October 1979. The field crew consisted of a supervisor and from 10 to 12 crew members at a time.

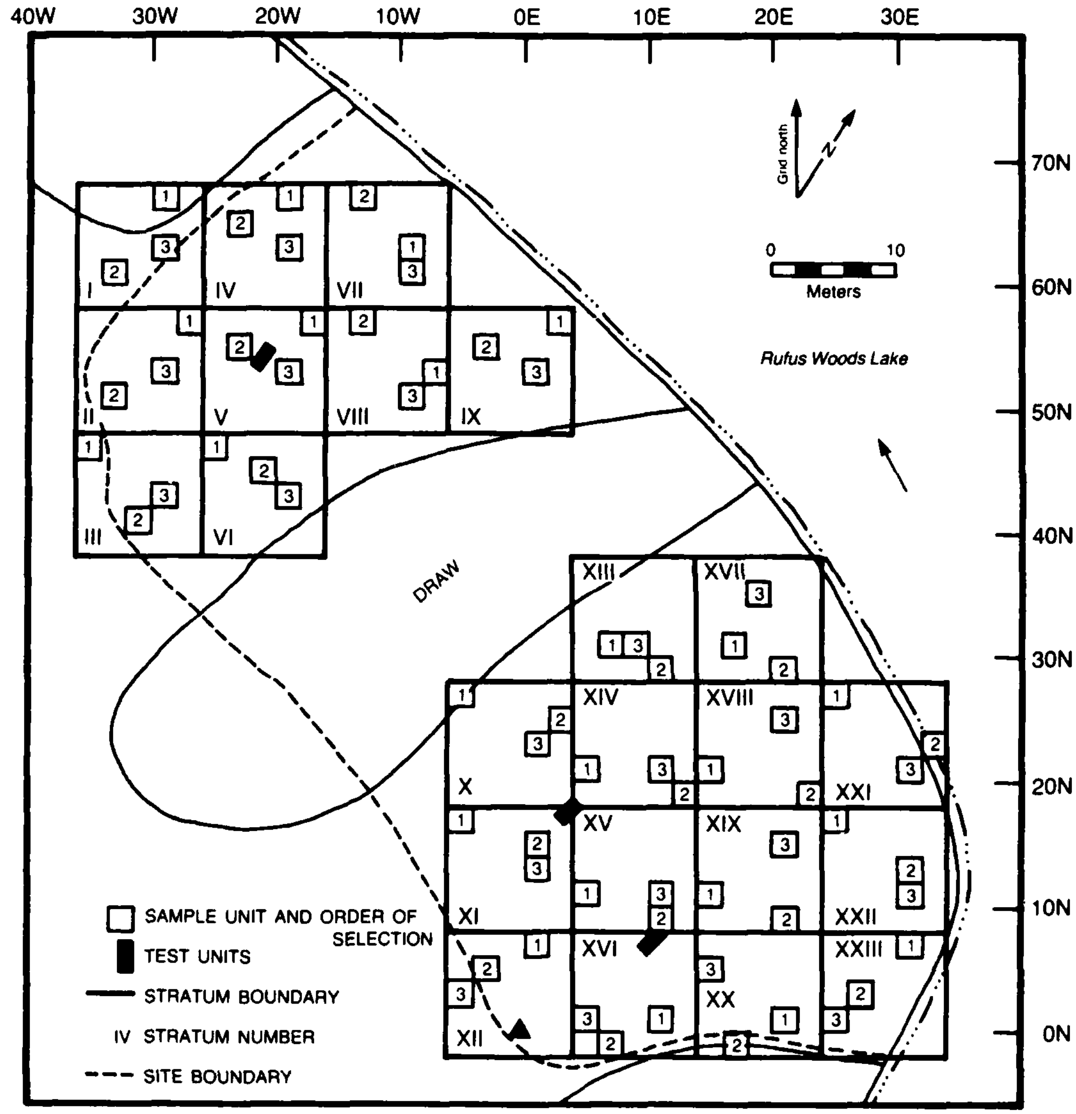


Figure 1-3. Sampling design and proposed order of sample unit excavation, 45-DO-211.

SAMPLING DESIGN

For full-scale excavation, a two-stage sampling design was used. For a detailed exposition of procedures used refer to Campbell (1984d). During the first stage, a **probabilistic** (randomly chosen) sample of units was selected. This provided unbiased data for characterizing site content. During the second stage, a **purposive** (non-random) sample was selected to provide additional information about site structure in the area of a previously tested surface depression.

Probabilistic sampling at 45-DO-211 was accomplished through a stratified unaligned systematic random sampling design. First, the site area defined during testing was subdivided into 23 **sampling strata** of equal size and shape, nine to the north of the central placer mining scar and 14 to the south (Figure 1-3). Each stratum consisted of a 10 x 10-m area with 25 primary 2 x 2-m sampling units. The sampling strata did not coincide with major 10-m grid intervals; they were offset 2 m to the south and 4 m to the east for a better fit over the defined site areas. Individual sample units were selected by randomly drawing x and y grid coordinates within 10 x 10-m sampling strata. Sample unit size was reduced to 1 m^2 when cultural deposits were shallow and had been disturbed by the historic placer mining. Selected sample units near the defined site boundary were left unexcavated if previous nearby units failed to produce cultural material. Also, a second level of sampling was introduced in site areas of pronounced artifact concentrations which called for a greater number of sample units of 1 x 2 m.

During the purposive stage of sampling, six 1 x 2-m and four 2-m^2 sample units were placed in the area of a buried house structure to provide information about the floor area and the structure's shape and stratigraphic context. Figure 1-4 shows the location of all excavation units.

EXCAVATION METHODS

Excavation units were either 1 x 2-m units or 2 x 2-m squares, subdivided into 1 x 1-m quads. The unit as a whole is designated by the northwest corner, but excavated materials were kept separate by quads. Vertical control was provided by 10-cm arbitrary levels, measured from the surface of the northwest corner of the 1 x 2-m or 2 x 2-m unit. Where greater control was desired, 5-cm levels were used.

Arrangements of artifacts and soil matrices contrasting distinctively with the surrounding matrix were designated as features. While feature designations were most commonly applied to cultural deposits, they were also used to separate different natural matrices occurring within the same arbitrary level. When excavators encountered a distinct matrix, whether geological or cultural, it was given a feature number and feature level materials were collected separately from unit level materials. Plan views were drawn and, if the thickness and complexity warranted, the feature was bisected and profiled. Geological features were handled in the same way as cultural features up to the analytic stage.

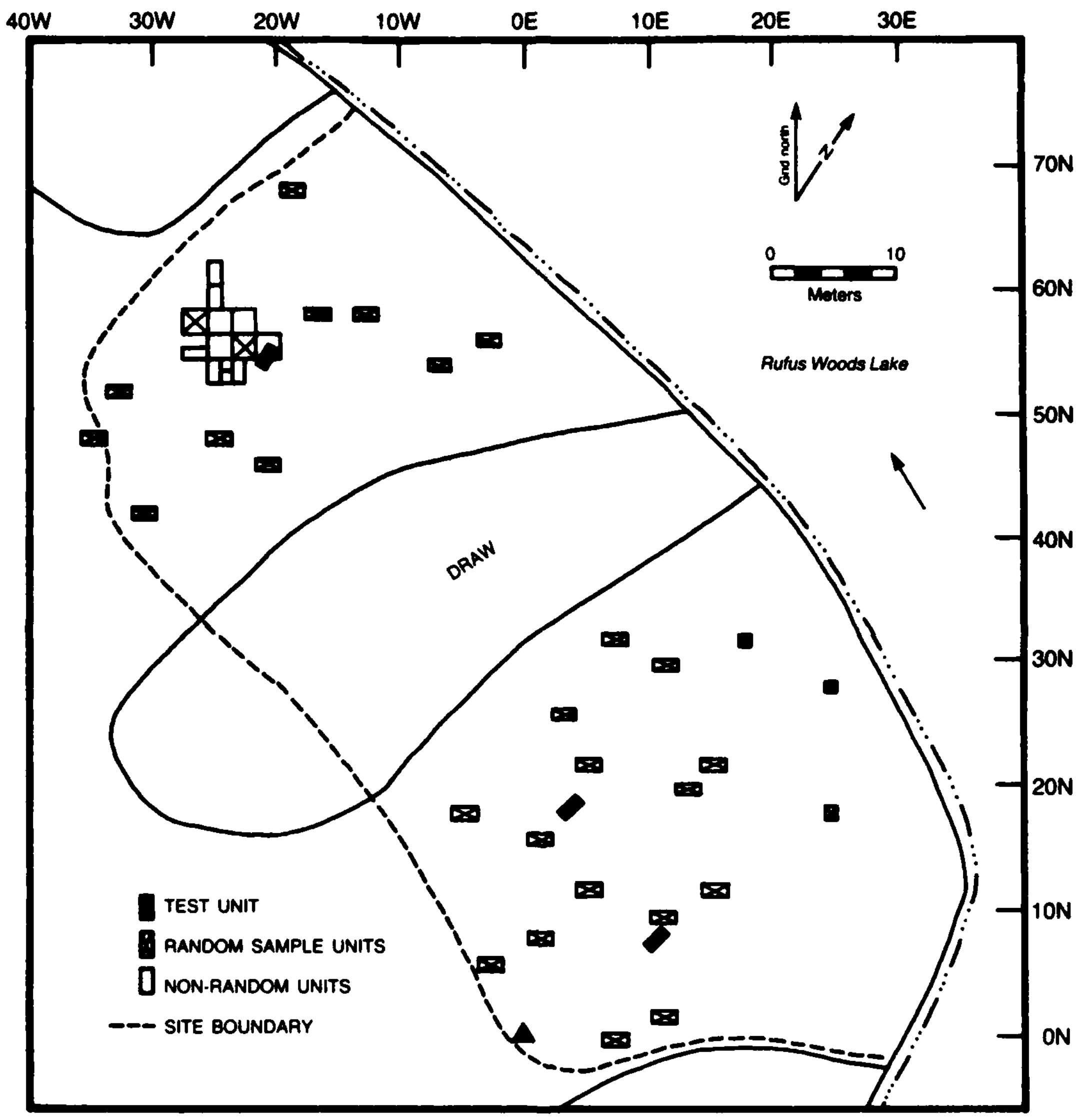


Figure 1-4. Units excavated, 45-DO-211.

Units were excavated by skimming with flat shovels, or by trowels when concentrations of artifacts, matrix staining, or features were encountered. The matrix was screened through 1/8-in mesh screens.

All cultural materials we.e taken into the project's field laboratory except FMR, which was classified in the field by material type, counted and weighed by type, recorded in two places, and discarded. Unmodified rock was not counted or weighed. Special samples such as radiocarbon samples and flotation samples were routinely collected and returned to the laboratory. For additional information on field and lab techniques the research design (Campbell et al. 1984d).

EXCAVATION RESULTS

Excavation at 45-DO-211 exposed 23 cultural features, including a well-defined housepit and three partially exposed housepits in two zones radiocarbon dated from ca. 3600-2700 B.P. In all, intensive excavation of the one housepit covered 35 m^2 (29 1 x 2-m random units, 12 1 x 2-m purposive units). The remainder of the site sample comprised 25 1 x 2-m and three 1 m^2 random units for a site total of 88 m^2 or 3.9 % of the total defined surface area. Six radiocarbon dates, spanning an interval from ca. 5500-2700 B.P., and a small collection of projectile point types supply reasonable chronological control. An assemblage of 5,504 lithic artifacts, 21,148 bone fragments, 9,793 pieces of shell, and 1,404 fire-modified rocks, and 71 nonlithic and historic artifacts was recovered. The lithic assemblage includes 386 worn and/or manufactured tools.

REPORT ORGANIZATION

The following chapters provide a guide to data from 45-DO-211. Chapter 2 discusses the site's sedimentary stratigraphy and the definition and dating of periods of cultural deposition termed zones. Chapters 3 and 4 summarize the results of artifact and archaeofaunal analyses. In Chapter 5, features are classified and their cultural contents described. Chapter 6 includes a site chronology and a discussion of possible activities represented by the assemblages from each zone. No archaeobotanical analysis was done for this site.

2. SEDIMENTARY STRATIGRAPHY AND CHRONOLOGY

This chapter discusses the geologic setting of site 45-DO-211 with reference to local geologic history and describes the sedimentary history of the site itself in detail. Strata mapped during excavation are grouped into site-wide depositional units, which provide the basis for determining how deposition occurred and for correlating cultural materials among units. The second half of the chapter discusses the cultural strata, or analytic zones, defined within this framework.

GEOLOGIC SETTING

Site 45-DO-211 is in the upper canyon of the project area. Here, the Columbia River flows along the eastern margin of the Waterville Plateau where the Columbia River Basalts contact the granitic rocks of the Colville Batholith. It is believed the river has flowed along the margin of the Plateau since the late Miocene outpouring of basalts. During the Pleistocene, the middle and northern reaches of the Columbia River drainage were overlain by ice-sheets. The Okanogan Lobe of the Cordilleran ice sheet entirely filled the upper canyon to the Grand Coulee, reaching its maximum extent between 13,000 and 14,500 B.P. The ice wasted away earlier in the upper canyon than in the lower canyon. As a consequence, river waters ponded behind the ice dam, and the upper canyon was filled with a thick profile of glaciolacustrine sediments. When the ice dam in the lower canyon was finally breached, the Columbia River rapidly downcut through the lacustrine sediments with occasional stillstands, creating a deep, narrow valley with a prominent terrace system. Mazama tephra Layer O has been observed in alluvial fans built on to the 1000 ft terrace, indicating that the river reached this elevation before 7000 B.P., and probably reached historic elevations shortly thereafter.

The rapid postglacial downcutting of the Columbia River left a deep canyon characterized by a well-developed terrace system and narrow channel, occurring entirely in bedrock. Depositional and erosional processes responsible for altering the landscape since this time include lateral migration, point bar, and overbank deposition of the Columbia River, alluvial fan development, colluvial deposition, and aeolian deposition. Little floodplain development has taken place in this narrow valley, but natural levees and abandoned channels can be recognized in some areas. Surfaces less than 20 m above the historic river levels commonly exhibit overbank deposits. While this stretch of the river is characterized by comparatively little meandering, local lateral migrations are recorded by the shape of the river,

point bar formation, and erosional episodes in site profiles. Alluvial fans have been built on the terraces at the mouths of tributary canyons. Few permanent drainages occur in the project area: most drainage is intermittent and unintegrated. Talus slopes are common at the base of both granitic and basaltic bedrock formations. Erosion and colluvial redeposition of the thick glaciolacustrine sediments in the upper canyon is common. This may take the form of major landslides or small deposits. Aeolian deposits cover the surface of all but the youngest landforms.

Site 45-DO-211 lies on the narrow downstream end of a terrace that slopes gently from 290 m at the river edge up to the 305 m contour (Figure 2-1). Cut by the Columbia River into older glaciolacustrine sediments, or Nespelem silt, the terrace is capped by channel deposits, including Columbia River gravel. In the site vicinity, the terrace is cut by several small draws. Two of these bound the site to the west and east, while another bisects it. Approximately 10 m wide, this central draw was deepened by placer mining operations before the turn of the century (cf., Thomas et al. 1984).

PROCEDURES

At 45-DO-211 the pedology crew profiled 41 excavation units totalling 170 linear meters of wall (Figure 2-2). We have excluded unit 48N36W from this analysis; it was composed entirely of stratified, compact silt and silt loam layers deposited by the placer mining sluice. Seven block columns were collected; three from the southern area of the site and four from the nothern.

In order to determine the site stratigraphy the block excavation area was first studied. Stratigraphic relationships could be observed directly across several meters of wall; noncontiguous units did not have to be correlated. These observations provided a preliminary model of the site depositional sequence, which was then applied to the rest of the site. Isolated units were arranged in seven transects (Figure 2-2) and correlations were made between adjacent units. We collated the field descriptions for each deposition unit (DU) in each excavation unit, in order to describe them. Although the draw bisects the site, the depositional histories of the two areas appear quite similar.

We have used the stratigraphic boundaries as temporal markers to aid us in subdividing the cultural deposits for analyses. The horizontal and vertical distribution of artifacts by quad and level was compared with the natural depositional sequence and feature boundaries. Those stratigraphic units containing a discrete cultural deposit were defined as analytic zones. Radiocarbon dates and diagnostic feature types were used to check our determinations. For a more detailed discussion of precedures used in defining analytic zones, see Campbell (1984d).

Additional information on the methods and procedures used in stratigraphic analysis and definition of zones can be found in the project's research design (Campbell 1984d).

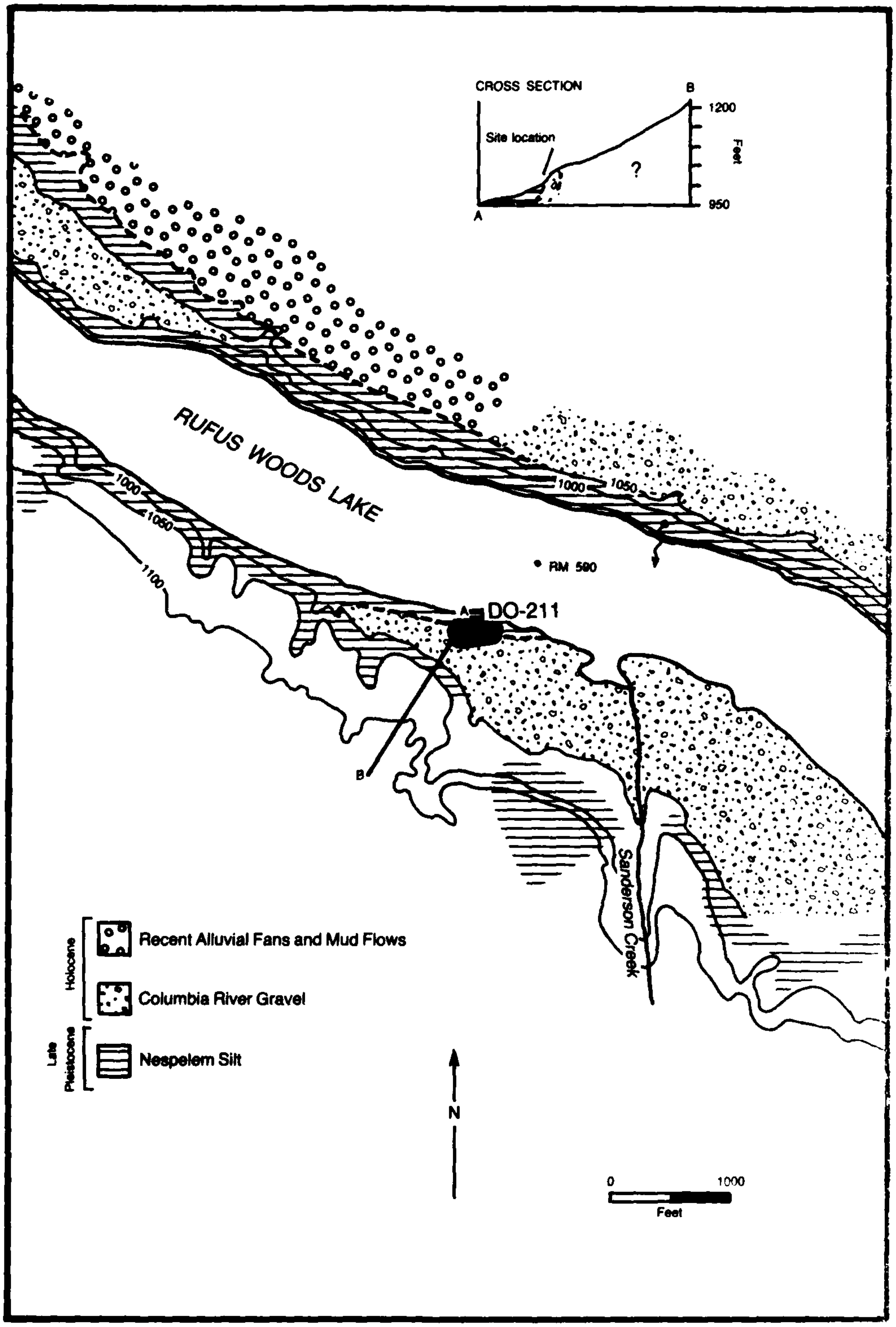


Figure 2-1. Geologic map of site vicinity, 45-DO-211.

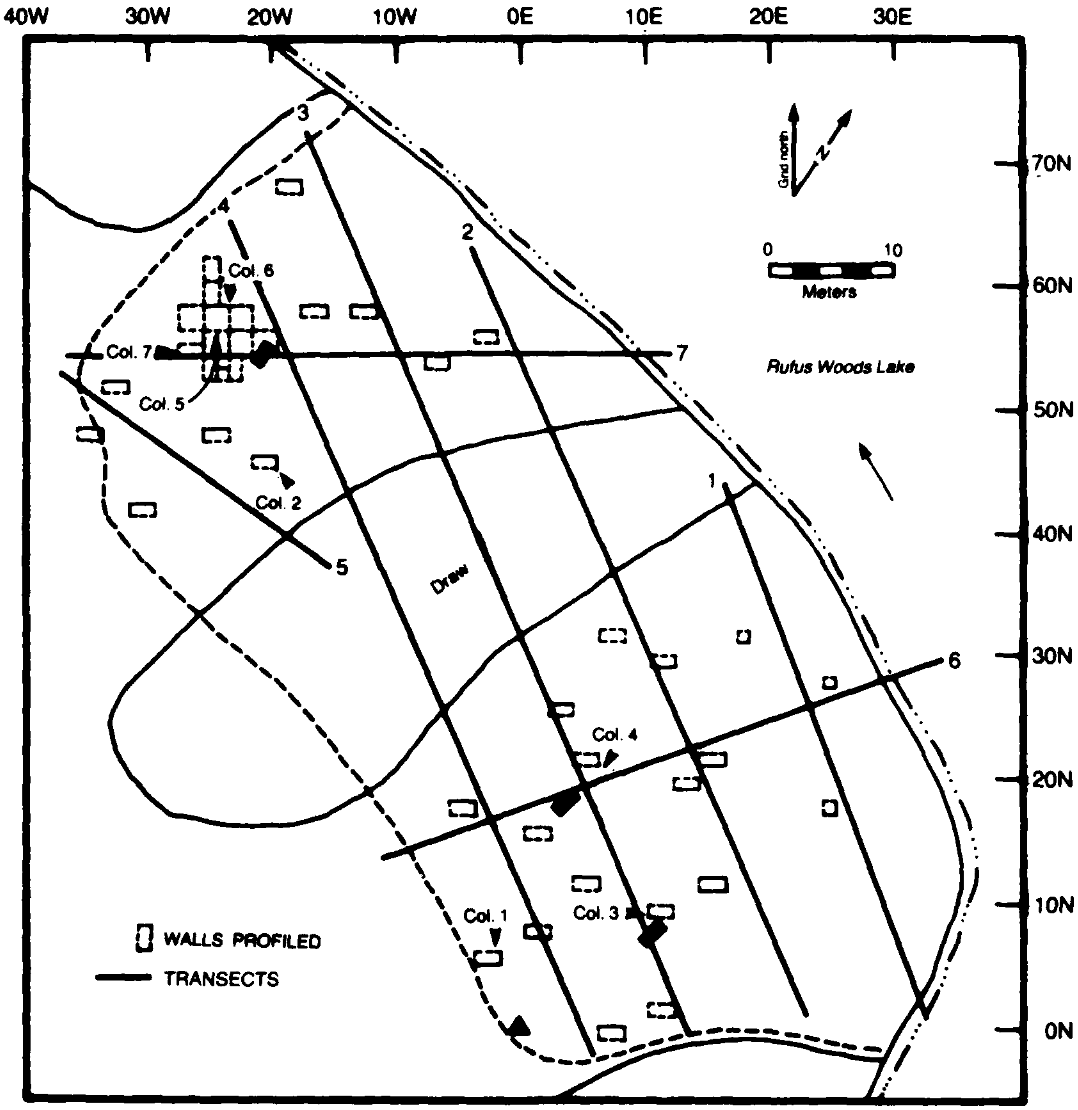


Figure 2-2. Location of profiled walls, column samples, and transects, 45-DO-211.

DEPOSITIONAL SEQUENCE

The depositional sequence at 45-DO-211 is summarized in Table 2-1. Profile transects are illustrated in Figure 2-3 through 2-5.

The oldest natural deposit at the site, DU I, is composed of sands and gravels, channel deposits left by the Columbia River when it cut the terrace from the underlying Nespelem silt formation. The lower stratum DU Ia, which occurs across the entire site, consists of cobbles and gravels with a fine sand matrix, light brown to light yellowish brown (10YR6/3-6/4). The upper surface of the cobbles slopes evenly down to the river. In the highest, or westernmost, areas of the site, sand (DU Ib) overlies the cobbles. The unit fines upwards from cobbles in a coarse sand matrix to sand alone, suggesting a point bar deposit laid down by the river as it migrated eastward. In the southern part of the site, the soft, unconsolidated sand is fine in texture, but in the housepit area it grades from coarse to medium. Sorting is variable. The color ranges from pale brown to light gray (10YR6/3 to 7/2), but is commonly salt and pepper. Dark grains--mafic minerals--are more abundant in this depositional unit than in overlying strata. This suggests that the sediments of DU I are more weathered than the younger sediments and may have been deposited more rapidly.

DU II is a series of overbank deposits that are more variable in texture and have a more complex bedding structure than later deposits. At the base of DU II in some areas is subunit DU IIa, a fine loamy sand that grades northward to compact, well sorted silt bands interbedded with sandy loam. These range in color from pale brown, light brownish gray, to light gray (10YR6/3, 6/2, 7/3). In the block area, the silt bands dip gently (10-15°) to the east and are truncated by the housepit structures at 58N26W (Housepits 1 and 2). Several strata of fine sand to silty loam (DU IIb), fining downwards and northwards, lie above and adjacent to this lower unit. These sediments are pale brown, very pale brown, light brownish gray and light gray (10YR6/3, 7/3, 6/2, 7/2). In the housepit block excavation area, small, intermittent bands of silt occur. As a whole, the sediments of DU II are lighter, more variable in color, and more finely bedded than overlying deposits. Fine sediments occurring in the form of silt bands are more common than in subsequent deposits; they were probably laid down in rather quiet water.

DUs III, IV, and V are overbank deposits with varying aeolian contribution. Although the average particle size is similar for each of these, the sorting increases upwards, as does the hardness. The average stratum thickness decreases upwards, and the color darkens. Better sorting in DU IV may indicate a greater proportion of aeolian sediments.

DU III is a soft, moderately sorted to moderately well sorted sandy loam to loamy sand, fining away from the river. The sediments are well sorted and compact, with clear to abrupt boundaries, and range from light gray to light brownish gray and pale brown (10YR7/2, 6/2, 6/3). In the housepit area, small, light colored, siltier patches occur. Housepit 2 originates at the surface of this deposit.

Table 2-1. Summary of field profile descriptions[1] by depositional unit, 45-DO-211.

Depositional Unit	Predominant Colors		Particle Size [ϕ]		Soil Texture Classification (U.S.D.A.) (%)					Size Sorting (%)					Consistence (%)				Stratum Continuity (%)	
	Color	%	$\bar{x}$	s.d.	Silt loam	Loam	Sandy loam	Loamy sand	Sand	Poorly sorted	Moderately sorted	Moderately well sorted	Well sorted	Very well Sorted	Loose	Soft	Slightly Hard	Hard	< Unit	> Unit
VI N=58	10YR 5/2 10YR 5/3	52 40	3.19	0.49	-	2	67	22	8	-	73	3	23	-	9	75	16	-	7	93
V N=11	10YR 5/3 10YR 6/3 10YR 5/2	58 25 17	3.05	0.39	-	-	56	44	-	-	40	-	60	-	-	54	46	-	-	100
IV N=27	10YR 6/3 10YR 5/3	50 34	2.84	0.56	-	-	50	35	17	-	70	10	20	-	17	79	4	-	8	92
III N=35	10YR 6/3 10YR 7/2 10YR 6/2 10YR 7/2-6/3	28 22 22 19	3.12	0.54	11	-	52	26	11	7	50	25	18	-	14	64	18	4	26	74
IIb N=28	10YR 7/2 10YR 6/3 10YR 7/2-6/3 10YR 7/3	37 30 11 7	3.48	0.68	14	14	50	23	-	14	43	24	19	-	8	42	38	12	50	50
IIa N=7	10YR 7/3 10YR 7/2 10YR 8/2	63 25 13	3.94	0.76	29	-	71	-	-	22	33	11	33	-	13	13	13	63	29	71
Ib N=14	10YR 6/3 10YR 7/2	71 29	1.56	0.68	-	-	-	14	86	38	-	25	38	-	83	13	-	-	14	86
Ia N=28 (Matrix only)	10YR 6/3 10YR 6/4	80 13	1.53	0.79	-	-	-	14	86	85	29	6	-	-	67	33	-	-	-	100

Depositional Unit	Thickness of Intrazonal Strata (cm)		Cultural and Biotic Disruption (% strata)					Intrazonal Boundaries								Interzonal Boundaries							
								Shape(%)				Clarity(%)				Shape(%)				Clarity(%)			
	$\bar{x}$	s.d.	Roots	Housepit	Krotovina	Staining	None	Broken	Irregular	Wavy	Smooth	Diffuse	Gradual	Clear	Abrupt	Broken	Irregular	Wavy	Smooth	Diffuse	Gradual	Clear	Abrupt
VI	23.1	10.7	67	-	3	5	33	-	-	-	-	-	-	-	-	-	3	47	50	-	36	56	8
V	27.1	9.6	7	-	7		88	-	-	-	-	-	-	-	-	-	-	50	50	-	50	50	-
IV	29.3	11.3	10	-	10	-	81	-	-	-	-	-	-	-	-	4	11	52	33	-	17	83	10
III	33.2	14.4	-	18	11	-	71	-	-	-	-	-	-	-	-	3	3	68	16	-	24	44	32
IIb	29.5	12.5	-	43	10	10	38	10	40	40	10	5	18	41	36	14	43	36	7	7	7	40	47
IIa	16.7	6.5	-	-	29	29	57	-	-	-	-	-	-	-	-	-	57	29	14	-	-	50	50
Ib	15.6	9.0	-	29	-	14	86	-	13	25	65	-	14	14	71	-	14	29	57	-	14	14	71
Ia	Base of Unit Not Exposed			-	6	-	94	-	-	-	-	-	-	-	-	-		-		-	-	-	-

[1] Individual field profile descriptions were tabulated. The results are presented as percentages of observations.

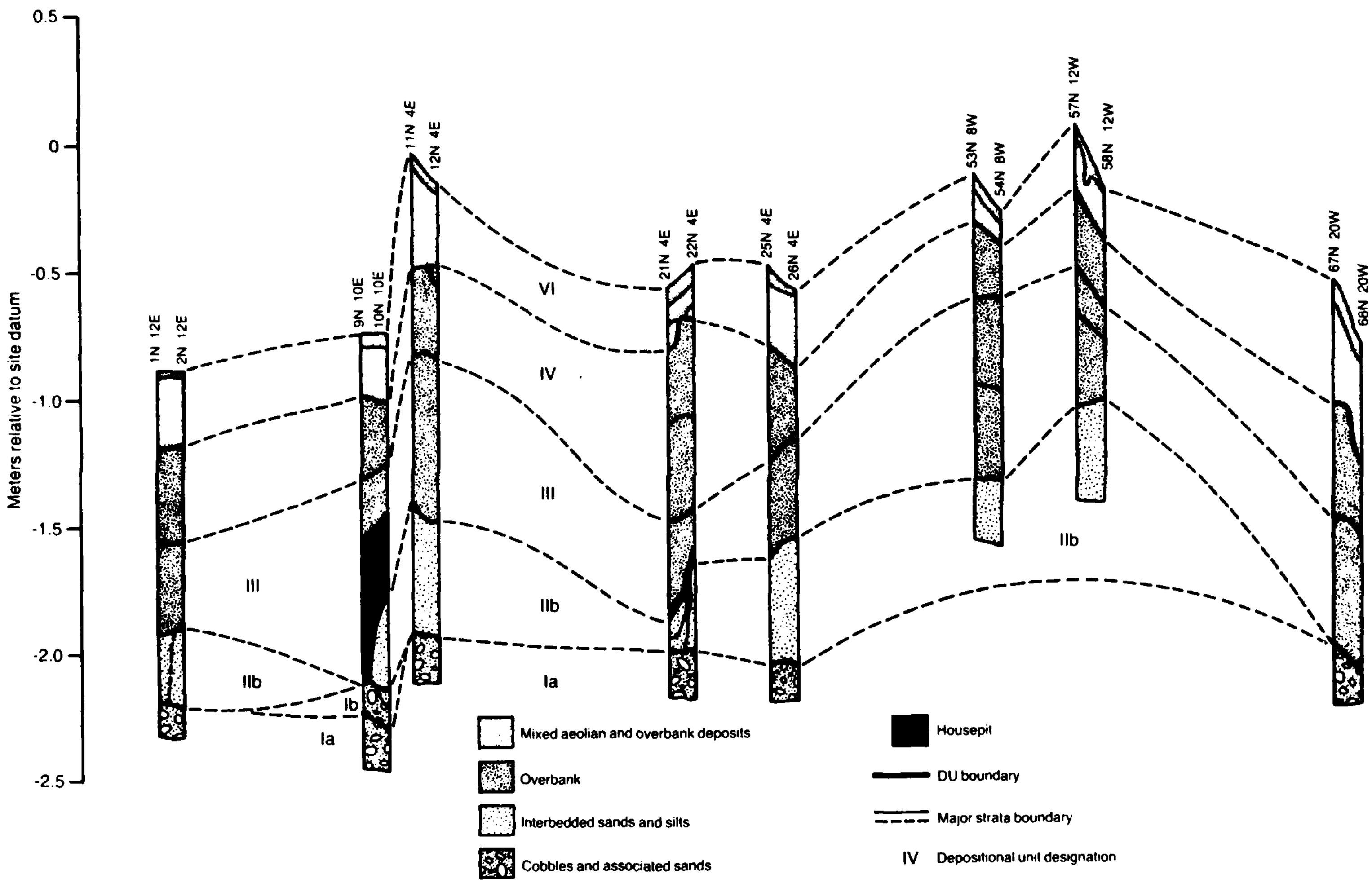


Figure 2-3. Stratigraphic transect #3, 45-DO-211.

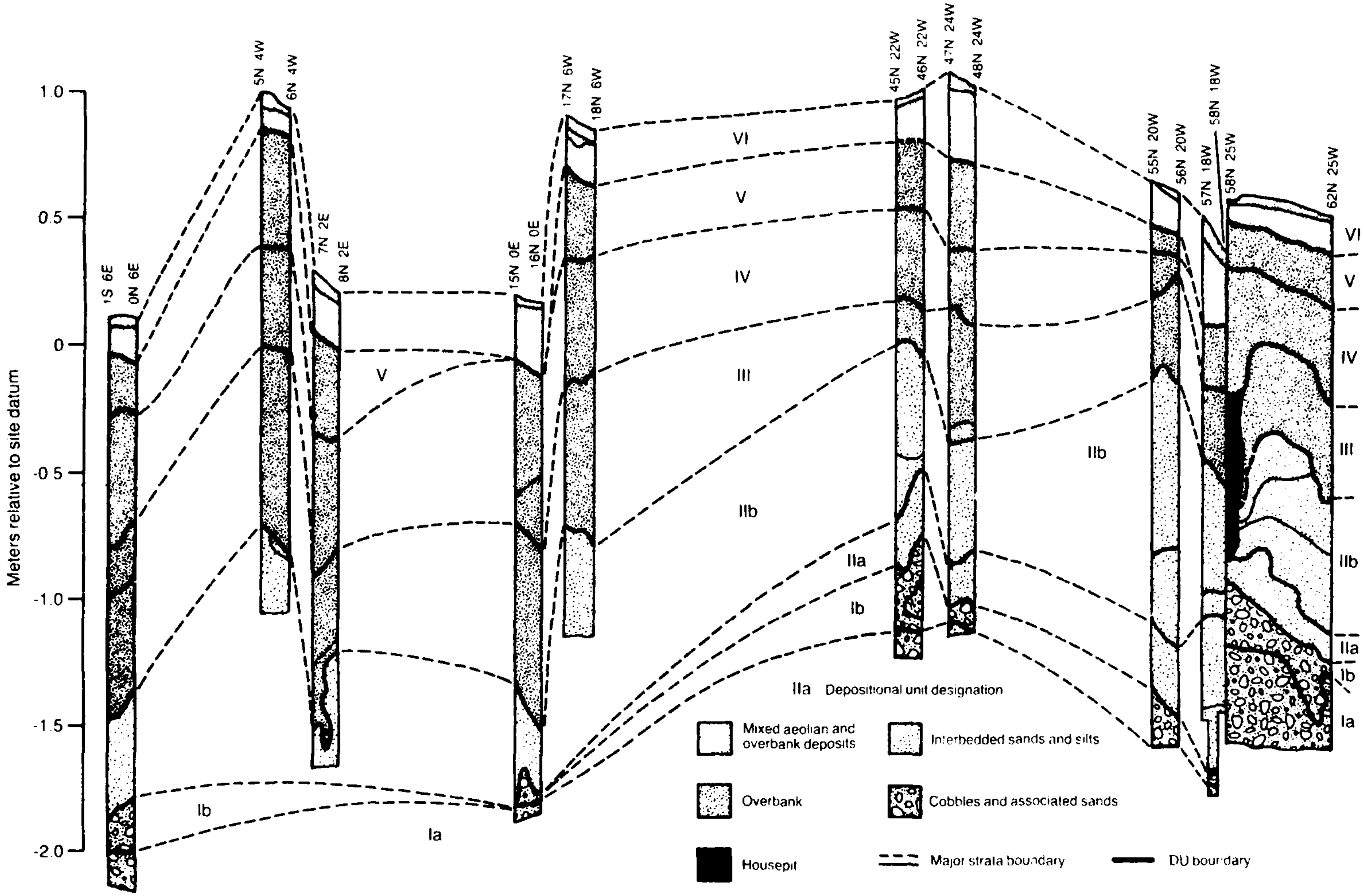


Figure 2-4. Stratigraphic transect #4, 45-DO-211.

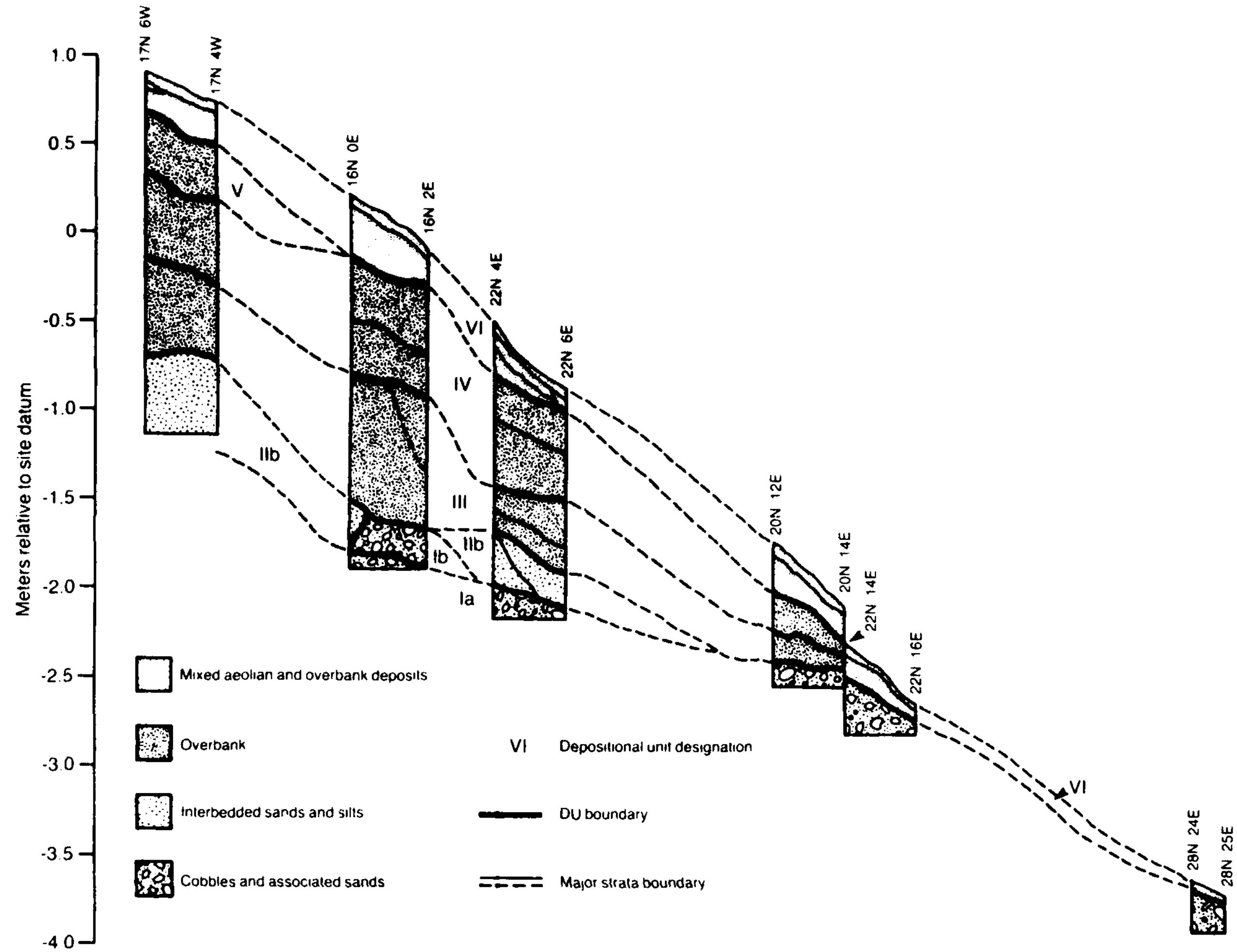


Figure 2-5. Stratigraphic transect #6, 45-DO-211.

DU IV consists of predominantly pale brown to brown (10YR6/3-5/3) sand to loamy sand, moderately sorted and soft. This unit occurs across the entire site except in the eroded riverfront area. In the housepit area, deposition of DU IV began after use of Housepit 2; the housepit fill is the initial deposit in this unit. The sediments within the housepit depression are similar to those of the remainder of DU IV; they include, however, a finer fraction (laid down in the water ponded in the depression) and are interbedded with slump deposits near the walls.

DU V is a loamy sand to sandy loam, soft, predominantly well sorted and brown (10YR5/3), darker than the underlying stratum. It occurs only in the northern area of the site.

DU VI includes the surface litter mat and the immediately underlying stratum, which is a brown to grayish brown (10YR5/2-5/3), sandy loam, soft moderately sorted, grading to well sorted in the north. It is more compact than DU V and darker, due to soil development. It is interpreted as a deposit of wind-modified overbank and aeolian materials. This unit is site-wide and is the only deposit above the cobbles at the eroded riverfront.

COLUMN SAMPLE DATA

Column sediment samples were subjected to various physical and chemical analyses (Appendix A, Tables A-2 through A-8). Of these, only sand/silt/clay fraction and grain rounding help us to evaluate the site's defined depositional units. The other physical and chemical characteristics measured are determined more by postdepositional processes or cultural activities than by site-wide natural depositional processes.

The column samples taken at 45-DO-211 intersect several cultural features, enabling us to study the effects of cultural activities on the sediments. Columns 5, 6, and 7 were taken in the block excavation of Housepit 1 and 2 (Figure 2-2). Columns 5 and 6 are within the housepit depression and intersect fill, floor, and underlying deposits. Column 7, a partial column beginning at 95 cm below unit datum (b.u.d.), is less than 2 m outside the housepits' walls; it samples a stained area in DU I, below the level of the housepits.

A fourth column in the northern area, Column 2, intersects no structures or other features. Column 3 is located in Housepit 3 in the southern site area; it intersects several layers of fill and a possible floor. Column 4 is in Housepit 4, which has a complicated sequence of fills, floors, and other features. No structures or other features occur where Column 1 was taken.

PHYSICAL ANALYSES

Measurements of sand/silt/clay fractions bear out the defined depositional units. DU I is characterized by the highest proportions of sand in each column, while DU II has the highest proportions of clay, sometimes with high proportions of sand as well. Fluctuations in the sand/silt/clay fractions between samples are greater in DU I and DU II than in overlying strata; this results from the finer bedding structure in these two units. We

could discover no pattern of grain rounding specific to particular depositional units; several depositional processes may have contributed to all of the units.

Organic ash/charcoal, probably due to cultural activities, tends to occur at trace levels throughout the columns. It is usually absent in DU I and DU II, where occupational debris occurs at lowest density. While the uppermost peak in organic material undoubtedly is due to vegetation, organic material lower in the columns may derive from cultural activity. Bone and shell are less ubiquitous; most occurrences correlate with features, indicating cultural deposition. The percentage of minerals is roughly complementary to the percentage of ash/charcoal, bone, shell and organic material.

CHEMICAL ANALYSES

In each column sample, pH follows a relatively smooth curve with slightly acid conditions in the litter mat and increasing alkalinity downwards. This pattern is due to pedogenic processes; it is relatively independent of both the depositional origin of the sediments and of cultural activities. Such a pH curve is normal in arid regions, where alkaline carbonates accumulate in the soil over time, neutralized only near the surface by the acids formed in the organic litter mat.

The calcium (Ca) and phosphate curves fluctuate considerably more than the pH curves. Some of these variations certainly are due to cultural activities, but noncultural processes such as pH also affect Ca and phosphate levels. Acidity tends to mobilize Ca and P ions and allow them to be absorbed by vegetation. In weakly to moderately alkaline soils, such as those at 45-DO-211, Ca and P are less mobile and will be retained in the sediments to a greater extent. Thus Ca and P levels in a given sample at 45-DO-211 are likely to be "fossilized" amounts derived from events contemporaneous with deposition.

The more soluble Ca does seem to have responded slightly to local horizontal and vertical variations in water movement. The depletion of Ca in Column 5 (Appendix A, Figure 1) may be due to a greater amount of leaching of soluble minerals. This location has been near the center of a depression since Housepit 1 was first excavated, and may have collected more runoff than the surrounding area. The only Ca in the column is above and coincident with a high proportion of clay in Samples 11-15. Other examples of high proportions of clay and/or silt correspond to calcium abundances (Column 2, Samples 10-13; and Column 4, Sample 8). When the sand pore space is filled by silt and clay, this less permeable sand delays the leaching of calcium. Cultural activities have affected the abundance of calcium to some extent: a Ca peak in Column 4 (Samples 11, 12) corresponds to high levels of shell and the presence of two cultural features.

Cultural activities have also increased the phosphate levels in the sediments. The phosphate peaks in Column 2 (Samples 17, 18), Column 3 (Samples 9, 10), Column 4 (Samples 6, 12, 16), Column 5 (Sample 14, 15) and Column 6 (Samples 6, 7, 8) are all from cultural features. Phosphate peaks and features, however, do not correspond in a one-to-one manner. Housepit 3

in Column 3, for example, has nearly the lowest phosphate levels in the column. Phosphate frequencies in cultural levels can vary greatly. For instance, Sample 8 of Column 5 (from Floor 2, Housepit 4) has the lowest phosphate levels in the column while Sample 16, which was taken from the same feature, has the highest. Some of the peaks in phosphate that do not correspond to recorded cultural peaks, such as Samples 10, 12, and 13 in Column 6, may correspond to the locations of cultural activities that left only perishable remains.

CULTURAL STRATIGRAPHY

Using the depositional units described previously, we can trace five distinct cultural peaks across the site. Table 2-2 correlates the depositional units with the zones and lists their contents. No cultural deposits seem to be directly associated with the oldest depositional unit, the cobble layer. Materials found in levels that included cobbles were assigned to the zone occurring immediately above the cobbles.

In addition to the five zones, two subzones were also defined. These represent deposits associated with Housepit 2 in the block excavation. They enable us to define assemblages at a spatial scale less than zone and greater than feature. Each zone, with subzone where relevant, is described below, beginning with Zone 5, the lowermost.

ZONE 5

The oldest cultural assemblage from 45-DO-211 is that associated with the interbedded fluvial sands and silts of DU I, IIb and IIa. The geological strata have a slightly more extensive distribution than is indicated for the zone (Figure 2-6). In some units a very thin layer of sand occurs above the cobbles at the base; this has not been designated as Zone 5 unless it includes at least two full unit levels and an indication of associated cultural materials. This assemblage probably includes several small occupations of different ages. The Housepit 1 floor, assigned to this zone, yielded radiocarbon dates of 3630 ±100 B.P. and 3505 ±74 B.P. It truncates an exterior occupation surface with a radiocarbon date of 5497 ±142 B.P. Because the strata are relatively thin, however, and do not have great horizontal extent, we cannot subdivide the zone further. Mixing of this zone and Zone 4 undoubtedly has occurred in the block area: Housepit 2 cuts down into the strata of DU I, IIa, and IIb. A smaller assemblage was recovered from these deposits than from the subsequent zones. This is probably a result of the lower density of cultural materials and the fact that this zone was excavated in fewer units.

ZONE 4

Zone 4 includes a peak of cultural materials that can be traced across the site in association with DU III. Because this deposit does not occur in the site's lower areas, the distribution of Zone 4 is confined to the upper

Table 2-2. The analytic zones of 45-DO-211: their stratigraphic definition, radiocarbon dates, and contents.

Zone	DU	Major Description	Radiocarbon[1] Dates (Years B.P.)	Lithic # Row %	Nonlithic # Row %	Bone # Row % (gms)	Shell # Row % (gms)	FMR # Row % (gms)	Historic # Row %	Total	# Features	Volume (m^3)	Density Objects (m^3)
1	VI	Aeolian and overbank deposits with soil development and litter mat.		628 54.3	6 .5	382 33.0 52	86 7.4 101	54 4.7 6,274	2 .2	1,158	-	23.7	48.9
2	V	Overbank deposits		1,361 18.1	12 .2	2,295 30.5 442	3,501 46.5 8,060	359 4.8 59,043	- -	7,528	3	26.4	285.1
3	IV	Overbank deposits		1,133 16.0	12 .2	2,577 36.3 447	3,184 44.9 6,534	189 2.7 36,335	- -	7,095	5	29.4	241.3
3:HP2 Fill	IV	Upper fill, Housepit 2		503 20.0	7 .3	1,489 59.3 270	463 18.5 717	46 1.8 6,683	1 -	2,509	1	11.5	218.2
4	III	Overbank deposits	2712±80 2781±116 3117±119	644 9.8	5 .1	4,233 64.8 635	1,483 22.7 1,887	169 2.6 27,204	3 -	6,537	6	25.3	258.4
4:HP2 Floor	III	Floor-lower fill, Housepit 2		481 5.1	10 .1	7,911 83.3 1,549	765 8.1 1,646	334 3.5 54,762	- -	9,501	3	7.7	1233.9
5	IIb IIa I	Interbedded sands and silts overlying cobbles	3505±74 3636±100 5497±142	685 20.6	10 .3	2,231 67.1 693	311 9.4 985	86 2.6 15,816	2 1	3,325	5	28.2	117.9
Unassigned	-	Unassigned		69 25.8	1 .4	30 11.2 3	- - -	167 62.5 26,022	- -	267	-	4.9	54.5

[1] See Appendix A, Table A-1.

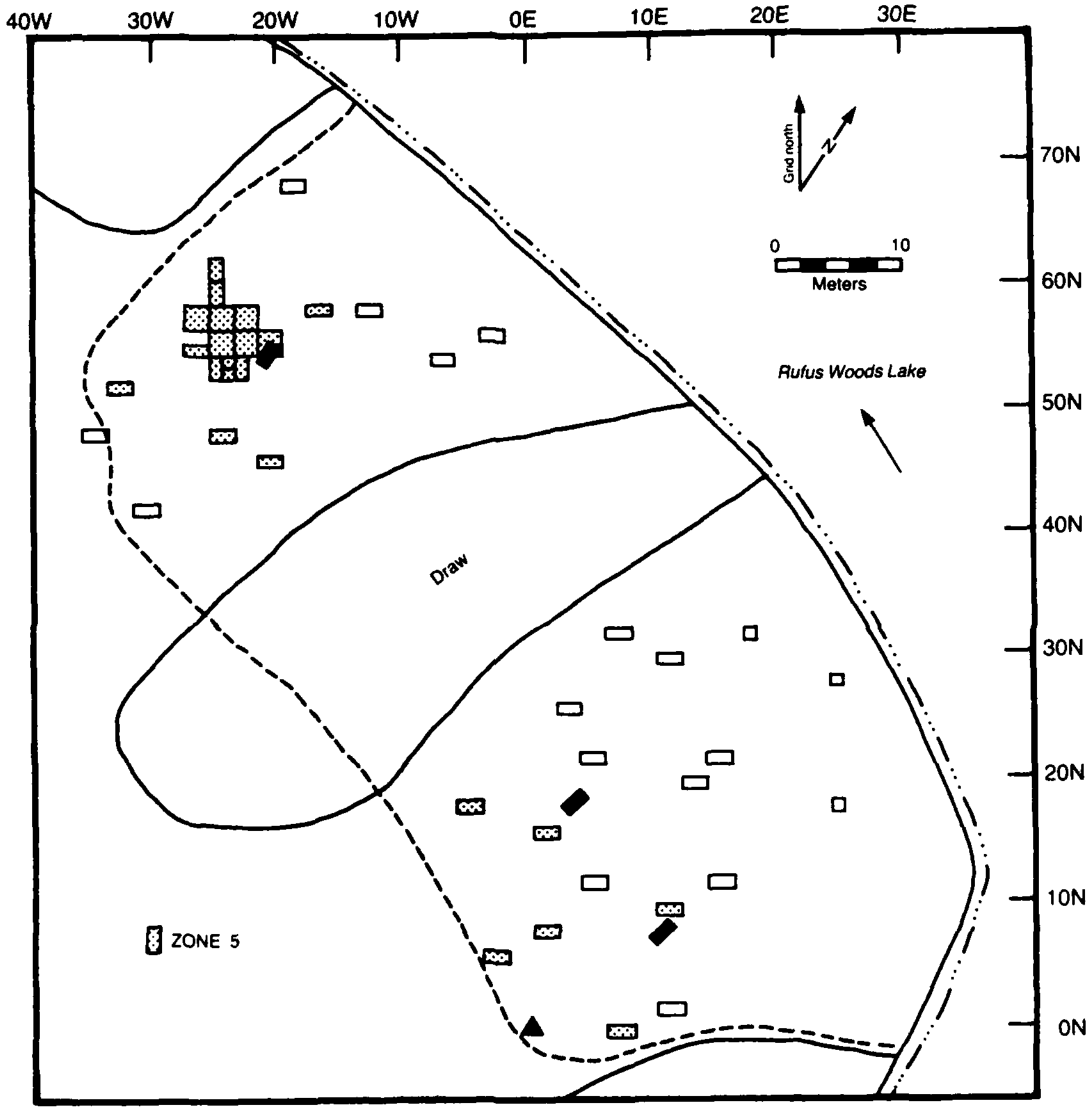


Figure 2-6. Extent of Zone 5, 45-DO-211.

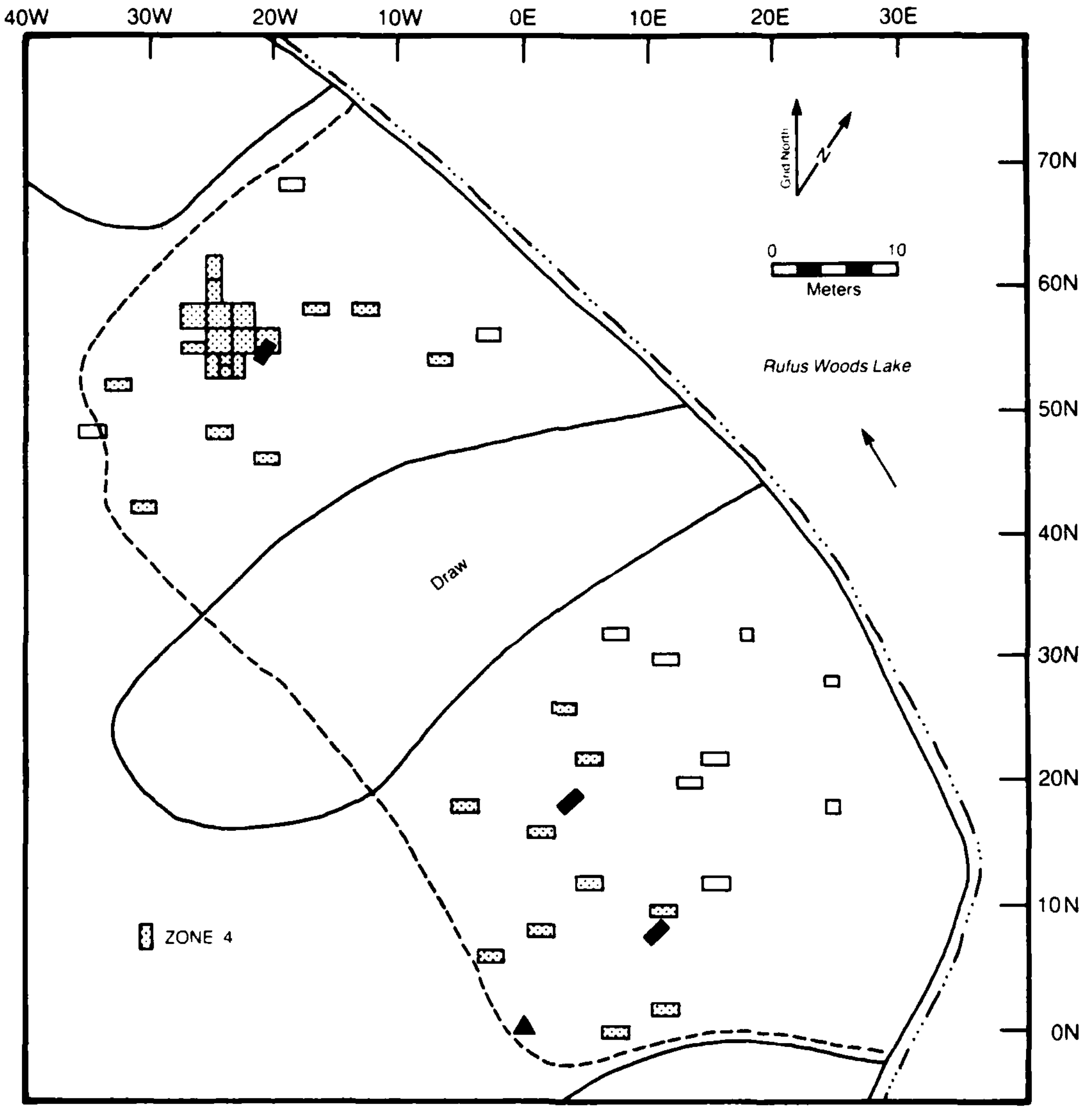


Figure 2-7. Extent of Zone 4, 45-DO-211.

portion of the terrace (Figure 2-7). Zone 4 yielded the largest temporally distinct cultural assemblage at the site. The floor of Housepit 2 was defined as a subzone (designated Zone 4:Housepit 2 Floor) so that the floor assemblage can be studied apart from the rest of the zone. A radiocarbon date of 2712 ±80 B.P. was obtained from the Housepit 2 floor. Two other housepits in this zone are represented by single excavation units and were not defined as subzones. The radiocarbon date of 3117 ±119 B.P. came from Housepit 3, that of 2781 ±116 B.P. from Housepit 4.

ZONE 3

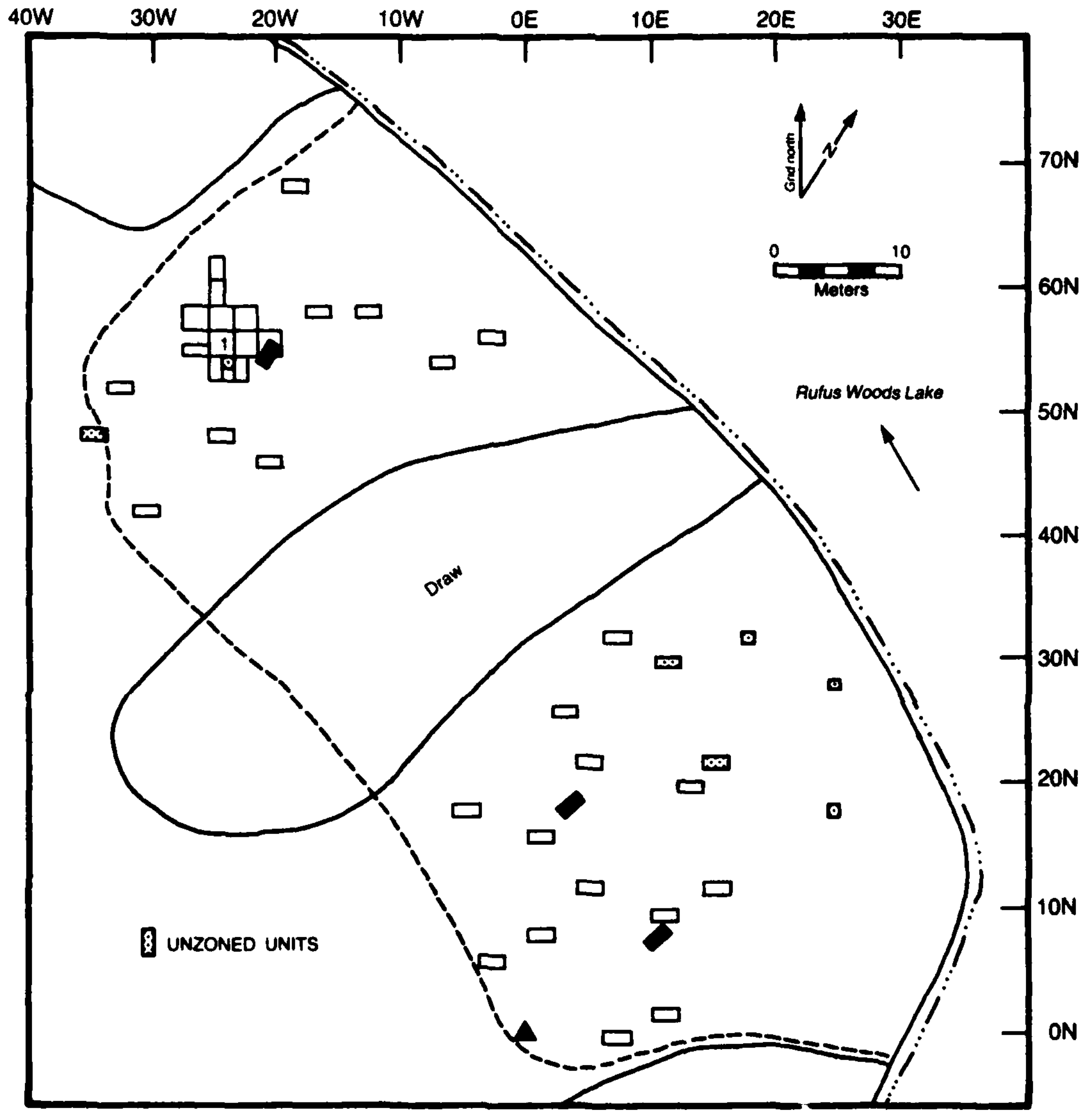
Zone 3, which corresponds to DU IV, was traced across the entire site except in unzonable units (Figure 2-8). In general, the deposit consisted of a single stratum with an associated high density peak of cultural materials. In the housepit in the block area, however, the upper layer of fill defined as part of this DU has its own distinct peak of cultural materials. Although some of the fill was excavated as Feature 57, much of it was excavated simply as unit level materials. To provide access to this data without feature amendments, the upper housepit fill was designated as a subzone (Zone 3:Housepit 2 Fill). Thus, the fill can either be examined separately from Zone 3 or with it. As can be seen in Table 2-2, the assemblage from Zone 3 is the second largest at the site, and the Housepit 2 fill assemblage itself is large enough to allow valid functional comparisons with the remainder of Zone 3 and with the housepit floor. No radiocarbon dates were obtained from this zone, however diagnostic artifacts indicate a date prior to 2000 B.P.

ZONE 2

Zone 2 was defined to include the peak in frequency of cultural materials associated with DU V. This was a stronger and more regular peak than that in Zone 1; the presence of three features and a large assemblage of lithics, FMR, bone, and shell (Table 2-2) indicates a definite cultural occupation. Like Zone 1, this zone was traced across the entire site, except in unzonable units (Figure 2-8). No radiocarbon dates were obtained from this zone, however diagnostic artifacts indicate a date prior to 2000 B.P.

ZONE 1

Only low density and intermittent peaks of cultural materials are associated with the sediments of DU VI. It is designated as a separate zone because historic material indicate it dates largely to historic times or was disturbed in historic times. The assemblage of lithics, fire-modified rock (FMR), bone, and shell in this zone is smaller than those of other zones, and no features were recorded, indicating at most a very low density occupation. This zone has a site-wide distribution, being absent only where units could not be assigned to a zone (Figure 2-8). No radiocarbon dates were obtained from this zone.



[1]54N25W was left as a baulk, then removed when endangered by slump. The first 40 cm (which included Zones 1 and 2) were not screened, the next 40 cm (40-80) screened together, and the remainder removed in 20 cm levels.

Figure 2-8. Location of unzoned units, 45-DO-211.

UNITS NOT ASSIGNED TO ZONE

Several entire units were not zoned (Figure 2-8). These include the five lowest units at the site 30N10E, 22N14E, 32N16E, 28N24E, and 18N24E. This area is an eroded beach where the cobble stratum, DU Ia, is exposed near the surface. Above the cobbles are some sediments and a few associated cultural materials. We cannot know how long the cobble stratum has been exposed or whether a thicker sequence of deposits on top of it have been removed, leaving a lag deposit. The materials could be coeval with those in any of the higher zones at the site. Unit 48N36W, from which seven lithics were collected, was also unzonable. It was determined in the field to consist entirely of hydraulic mining sluice deposits, and no profile was drawn.

SUMMARY

Cultural deposits at 45-DO-211 document activities from about 5500 B.P. to the present. The initial dated occupation consists of a charcoal-stained living surface in sandy fluvial deposits (DU I, IIa, IIb) lying above the DU I basal deposit of Columbia River channel cobbles and gravel. This feature is radiocarbon dated to 5497±142 B.P. A hiatus of about 1,900 years separates this living surface from the next dated occupation, Housepit 1, which is also included in Zone 5. Radiocarbon dates of 3636 ±100 B.P. and 3505 ±74 B.P. show that the occupation of this house is much closer in time to houses in Zone 4 than to the earliest cultural evidence in Zone 5. However, the badly disturbed remnants of this house were not readily separable from the older materials. Zone 4 contains the largest temporally distinct cultural assemblage at the site. This zone, which corresponds to DU III, an overbank deposit, consists of three housepits and associated shell scatters, bone scatters, and clusters of fire-modified rock. Radiocarbon dates from housepit floors and lower fill establish a temporal range of ca. 3100-2800 B.P.; Housepit 3 fill, 3117±119 B.P.; Housepit 4 floor 1, 2781±116 B.P.; Housepit 2 floor, 2712±86 B.P. Zones 3 and 2 correspond to subsequent periods of overbank deposition defined as DU IV and DU V respectively. Although neither zone is radiocarbon dated, diagnostic artifacts indicate a date prior to ca. 2000 B.P. While both zones contain relatively large cultural assemblages, they exhibit far lower artifact frequencies than the lower Zone 4. Nor is the stratigraphic record of prehistoric activity which is preserved in sparse shell scatters, use surfaces, and clusters of fire-modified rocks, nearly so complex. The uppermost zone, Zone 1, corresponds to DU VI, the surface litter mat and underlying aeolian sands. Activity here is marked by historic artifacts and indicative of homesteads and placer mining in the mid to late ninetheenth century and continued use of the site surface up to present. While non-Euroamerican debris is present, we cannot ascribe cultural affiliation or temporal period without diagnostic artifacts or clear artifact associations. This material might represent a very late pre-contact or ethnohistoric aboriginal occupation, or it may as easily be material dating to the lower Zone 2 and evidence of intensive surface disturbance of prehistoric deposits by historic Euroamerican activity.

3. ARTIFACT ANALYSES

Artifacts from site 45-DO-211 have been subjected to three separate analyses: technological, functional and stylistic. Technological analysis describes elements of prehistoric tool manufacture, detailing processes of lithic reduction. Functional analysis describes attributes of wear on tools and develops inferences concerning the use of tools at the site. Stylistic analysis describes morphological elements that have demonstrated temporal and spatial significance and compares recovered artifacts with types defined outside the project area.

Stone artifacts are treated in the most detail, other materials entering the classification only when specified attributes are applicable. Analyses were intentionally biased towards lithics with the assumption that these artifact classes would be of the most value in comparisons with other researchers' work and in developing reconstructions of site activities. Artifacts of bone, shell, and other non-lithic materials, though included in the classifications wherever appropriate, are only described in detail selectively.

All artifact analyses take the form of paradigmatic classifications as defined by Dunnell (1971, 1979). In this system, commonly used descriptive terms take on specific meanings. Attributes are selected which can describe morphological variation in the collection. These attributes may correspond to defined stages of tool manufacture, be characteristic of specific tool uses, or indicative of limited periods of time depending on the purpose of the classification. Attributes are combined into sets: those that describe morphological variation in the artifact assemblage without reference to cultural origin are called features, while those that represent cultural activity are called modes. During analysis each artifact is identified by the single feature or mode that characterizes it. By organizing the features and modes into larger organizations termed dimensions, and by cross-tabulating these, sets of comparable and mutually exclusive classes can be formed. From study of these classes, inferences may be drawn concerning the nature of tool manufacture, use, and distribution in time and space.

Our classificatory dimensions and constituent attributes are not always truly exhaustive and must be viewed as gross analytic categories designed to signal obvious morphological variation. Whenever possible, our defined attributes approximate characteristics identified in prior research as important technological, functional, or stylistic indicators. Further, it will be apparent that analytic levels within the paradigmatic classifications often preclude direct comparison with more traditional typological approaches. For example, in several instances these analyses will focus on the tool, and

not on the artifacts, because an artifact may have more than one tool or use. These classes are then only related to more standard classifications by cross-correlation with more traditional artifact designations (e.g., biface, drill, or chopper). The following discussion, therefore, involves analysis both at the level of the tool and of the artifact.

In the following subsections we present the descriptive data from technological, functional, and stylistic analysis. The bulk of the data is summarized in tabular form, with text largely reserved for discussion and interpretation of major points. Brief explanations of dimensions and attributes used in each analysis are presented at the beginning of each subsection. Introductory tables list the attributes corresponding to each classificatory dimension.

Artifact analyses will be presented with reference to the five zones defined in Chapter 2--Zone 5, Kartar/Hudnut Phase (ca. 5400-3500 B.P.); Zones 4 and 3, Hudnut Phase (ca. 3100-2000 B.P.); Zones 2 and 1, Coyote Creek Phase (Ca. 2000-0 B.P.). The two subzones--the upper fill of Housepit 2, Hudnut Phase (post 2500-2000 B.P.), and the floor of Housepit 2 (ca. 2700 B.P.)--are shown separately in descriptive tables for comparison to the sitewide zones.

TECHNOLOGICAL ANALYSIS

Prior researchers have described general manufacturing sequences in the production of stone tools, and have thereby identified specific morphological elements associated with certain methods of production and particular steps in the reductive sequence (e.g., Crabtree 1972, 1967a,b; Flenniken and Garrison 1975; Muto 1971, 1976; Smith and Goodyear 1976; Speth 1972; Stafford 1977; Swanson 1975).

While the process of lithic reduction may vary greatly even within defined industries, an idealized trajectory of reduction, with certain fundamental steps, can be constructed. First, the knapper selects a nodule which will serve as a core for the production of flakes of suitable size and shape. The first flakes removed exhibit the weathered surface of the stone. Later flakes show little or no weathered surface, and may have flake scars from the initial flaking. All of these flakes may be removed with a hard hammer of stone, and this creates distinctive large flakes with pronounced bulbs of percussion, strong stress lines, and crushed striking platforms. Once flakes are of a suitable size, the knapper modifies them further with a soft hammer of antler or wood, producing smaller flakes with less pronounced bulbs of percussion, finer stress lines, and little or no crushing of the striking platforms. Later, after the artifact has been roughed out to the desired shape, the knapper may remove still smaller flakes with an antler tine to sharpen, finely shape, and maintain working edges on the tool.

This is, of course, an extreme simplification. Not only are there innumerable variations in the sequence of steps and tools used, there are also several related processes with distinctive steps and products. The above description characterizes a flake tool technology, wherein hammers of different materials are used to detach thin, lamellar flakes by direct percussion. There is a related blade industry, where hammers or punches are

used to create long, narrow flakes with prismatic cross sections. This technique requires a more prepared core, and may involve indirect as well as direct percussion (cf., Leonhardy and Muto 1972; Muto 1976). In turn, these industries may be contrasted with the microblade industry which calls for the creation of small, carefully prepared wedge-shaped cores and use of fine fabricators for detachment of flakes. Very small, thin blades with one or more arrises are produced, which are in themselves finished tool forms requiring no further modification (cf., Sanger 1968, 1970). While clearly distinct, these three industries need not have been independent, as one could easily complement the others as part of a more comprehensive industry. That this is in fact the case is suggested by the presence of flake and blade industries in early assemblages on the Columbia Plateau (Leonhardy and Rice 1970; Leonhardy et al. 1971).

The best indicators of these lithic industries are specific artifact forms. Core configuration is distinctive; flakes, blades, and microblades are also readily distinguished. Products which have been further reduced may yet evidence attributes of orgin such as arris remnants or striking platforms. Other characteristics such as flake size, presense or absence of cortex, though quite recognizable, are less certain diagnostic indicators if specific technologies.

In technological analysis, we record attributes indicative of different steps in stone tool manufacture, and different types of reduction techniques. Our technological analysis makes use of seven dimensions: OBJECT TYPE, MATERIAL, CONDITION, DORSAL TOPOGRAPHY, TREATMENT, KIND OF MANUFACTURE, and MANUFACTURE DISPOSITION. These describe the kind and condition of artifacts and the materials from which they are made. Descriptive attributes of WEIGHT, LENGTH, WIDTH, and THICKNESS are also measured, and supplement the classificatory dimensions. Table 3-1 lists these dimensions and their constituent attributes.

We will first examine the range of material types and then the types of objects present. We will make inferences about the nature of lithic reduction by examining material, object type, type of manufacture, treatment, dorsal topography, and flake size. While these are admittedly crude indicators, they should enable us to determine the sorts of stone tool productions present at the site. When analyzed by distribution over zones and in cultural features, these indicators will also allow us to make inferences about changes over time and the use of space in any defined period.

MATERIAL TYPES

Cryptocrystalline stones are the dominant material types in the site assemblage (Table 3-2). Of these, jasper constitutes the largest percentage of the total (37.3%), followed by opal (17.4%), and chalcedony (15.1%). Petrified wood comprises only 0.1%. The most frequently occuring non-cryptocrystalline stone is a coarse-grained, tabular-fracturing quartzite (18.7%). No other stone exceeds 2.0% (fine-grained quartzite) of the assemblage. Basalt and argillite are noticeably infrequent (basalt, 1.7%; fine-grained basalt, 1.6%; argillite, 1.8%). Obsidian makes up only .1%.

Table 3-1. Technological dimensions.

DIMENSION I: OBJECT TYPE	DIMENSION V: TREATMENT
Conchoidal flake	Definitely burned
Chunk	Dehydrated (heat treatment)
Core	
Linear flake	ATTRIBUTE I: WEIGHT
Unmodified	
Tabular flake	Recorded weight in grams
Formed object	
Weathered	ATTRIBUTE II: LENGTH
Indeterminate	
	Flakes: length is measured between the point of impact and the distal end along the bulbar axis
DIMENSION II: RAW MATERIAL*	
Jasper	Other: length is taken as the longest dimension
Chalcedony	
Petrified Wood	
Obsidian	ATTRIBUTE III: WIDTH
Opal	
Quartzite	Flakes: width is measured at the widest point perpendicular to the bulbar axis
Fine-grained quartzite	
Basalt	
Fine-grained basalt	
Silicized mudstone	Other: width is taken as the maximum measurement along an axis perpendicular to the axis of length
Argillite	
Granite	
Siltstone/mudstone	
Schist	ATTRIBUTE IV: THICKNESS
Graphite/molybdenite	
Bone/antler	Flakes: thickness is taken at the thickest point on the object, excluding the bulb of percussion and the striking platform
Ochre	
Shell	
Dentalium	
DIMENSION III: CONDITION	Other: thickness is taken as the measurement perpendicular to the width measurement along an axis perpendicular to the axis of length
Complete	
Proximal fragment	
Proximal flake	
Less than 1/4 inch	
Broken	
Indeterminate	
DIMENSION IV: DORSAL TOPOGRAPHY	
None	
Partial cortex	
Complete cortex	
Indeterminate/not applicable	

* Only those raw materials recorded from 45-DO-211 are listed here; a complete list is available in the Project's Research Design (Campbell, 1984).

Table 3-2. Count of material by zone, 45-DO-211 (number is shown over column percent).

Material Type	Zone								Total
	1	2	3	4	5	3:HP2 Fill	4:HP2 Floor	Unassigned	
Jasper	315 49.5	667 48.6	530 46.3	223 34.2	72 10.3	127 24.9	96 19.6	51 72.9	2,081 37.3
Chalcedony	90 14.2	150 10.9	147 12.8	90 13.8	163 23.4	104 20.4	94 19.1	2 2.9	840 15.1
Petrified wood	1 0.2	2 0.1	1 0.1	- -	- -	2 0.4	1 0.2	1 1.4	8 0.1
Obsidian	2 0.3	1 0.1	2 0.2	- -	- -	- -	- -	- -	5 0.1
Opal	98 15.4	221 16.1	189 16.5	147 22.5	131 18.8	113 22.1	72 14.7	- -	971 17.4
Coarse-grained Quartzite	81 12.7	237 17.3	177 15.5	127 19.5	148 21.2	97 19.0	165 33.6	9 12.9	1,041 18.7
Fine-grained quartzite	7 1.1	13 0.9	15 1.3	16 2.5	43 6.2	13 2.5	7 1.4	- -	114 2.0
Basalt	5 0.8	11 0.8	17 1.5	12 1.8	28 4.0	10 2.0	14 2.9	- -	97 1.7
Fine-grained basalt	3 0.5	18 1.3	18 1.6	10 1.5	7 1.0	19 3.7	13 2.6	2 2.9	90 1.6
Silicized mudstone	-	2 0.1	2 0.2	2 0.3	15 2.2	3 0.6	6 1.2	1 1.4	31 0.6
Argillite	23 3.6	28 2.0	22 1.9	12 1.8	2 0.3	12 2.3	1 0.2	1 1.4	101 1.8
Granitic	-	4 0.3	5 0.4	1 0.2	8 1.1	1 0.2	6 1.2	1 1.4	26 0.5
Silt/Mudstone	3 0.5	6 0.4	8 0.7	3 0.5	68 9.8	2 0.4	6 1.2	1 1.4	97 1.7
Schist	- -	- -	- -	1 0.2	- -	- -	- -	- -	1 0.0
Graphite/ Molybdenite	- -	1 0.1	- -	- -	- -	- -	- -	- -	1 0.0
Bone/Antler	- -	2 0.1	- -	3 0.5	6 0.9	2 0.4	8 0.6	- -	21 0.4
Dentalium	- -	- -	- -	1 0.2	- -	- -	- -	- -	1 0.0
Ochre	6 0.9	10 0.7	12 1.0	1 0.2	4 0.6	5 1.0	2 0.4	1 1.4	41 0.7
Indeterminate	2 0.3	- -	- -	3 0.5	2 0.3	1 0.2	- -	- -	8 0.1
TOTAL	636	1,373	1,145	652	697	511	491	70	5,575

OBJECT TYPES

Conchoidal flakes, the most common object type make up 74.5% of the collection (Table 3-3). Tabular flakes (15.1%) and chunks (7%) comprise the majority of other object types. Formed objects (1.7%) and unmodified objects (1%) are not numerous. Cores, an obvious technological indicator, are rare, numbering only eight specimens or .2% of the total assemblage. The majority of all object types except tabular flakes were made of cryptocrystalline stones (68.8% of the total). Tabular flakes are almost entirely of the coarse-grained quartzite (99.2%). Of formed objects, 66.6% are cryptocrystalline, with another 22.9% made of non-cryptocrystalline stones encompassing quartzite, fine-grained quartzite, basalt, fine-grained basalt, and argillite. Six of the eight cores are cryptocrystalline, with one quartzite and one basalt. Chunks, like the conchoidal flakes, are predominantly cryptocrystalline (73.3%), with the rest primarily quartzite (8.5%) or siltstone/mudstone (14.5%). Nine flakes of jasper or chalcedony were placed in the linear flake category. This category which includes parallel-sided flakes less than 1 cm in width and approximately twice as long as they are wide, was created to identify possible microblades. Because diagnostic microblade cores are absent from the 45-DO-211 collection and the flakes in the category do not consistently display the microblade platform characteristics or multiple arrises, the linear flakes are not considered to be products of a microblade industry. Unmodified objects are basalt (4.1%), granite (14.3%) or siltstone/mudstone (79.6%).

MANUFACTURE

Of the object types in the collection, 94.7% show no evidence of further manufacture after the detachment of the object from the core or prior to use. All of those that were further modified were chipped (3.2%). Another 105 specimens were classified as Not Applicable/Indeterminate. Chipping accounts for all of the object types except those that were used without manufacture prior to use or those in the unmodified category (Table 3-4). Unmodified forms are cobble tools used without preparation or on which heavy attrition through wear and intentional manufacture could not be distinguished.

Use of heat treatment in the reduction of stone is difficult to determine. Of the object types in the collection, 3.4% show crazing, potlidding, and/or discoloration indicative of burning (Table 3-5). Another 6.1% (N=306) show dehydration, which, although a possible indicator of heating prior to flaking, is also a natural characteristic of opal. Table 3-6 indicates the high correlation of this attribute with opal: opal constitutes 82% of the dehydrated specimens. Artifacts with burning are predominantly jasper (64.8%) and chalcedony (26.2%), stones which are made more workable by controlled heating prior to flaking.

Table 3-3. Material by object type, 45-DO-211.

Material Type	Conchoidal flake	Linear flake	Tabular flake	Chunk	Core	Formed object	Weathered	Unmodified	Indeterminate	Total[1]
Jasper	1609	5	1	153	2	30	2	–	–	1802
Chalcedony	713	4	–	43	3	12	–	–	–	775
Petrified wood	7	–	–	–	–	1	–	–	–	8
Obsidian	2	–	1	–	–	1	–	–	–	4
Opal	774	–	–	62	1	15	–	–	1	853
Quartzite	225	–	746	30	1	6	–	–	–	1008
Fine-grained quartzite	102	–	2	6	–	1	–	–	–	111
Basalt	77	–	–	1	1	10	2	2	2	95
Fine-grained basalt	82	–	1	2	–	1	1	–	–	87
Silicized mudstone	28	–	–	1	–	2	–	–	–	31
Argillite	86	–	–	–	–	2	–	–	–	88
Granitic	14	–	–	1	–	1	1	7	1	25
Silt/Mudstone	–	–	1	51	–	3	–	39	3	97
Schist	1	–	–	–	–	–	–	–	–	1
Graphite/Molybdenite	–	–	–	1	–	–	–	–	–	1
Indeterminate	1	–	–	1	–	2	–	1	3	8
TOTAL	3721	9	752	352	8	87	6	49	10	4994

[1] <1/4 in flakes and non-lithics deleted.

Table 3-4. Count of type of manufacture by zone, 45-DO-211.

Type	Zone								Total[1]
	1	2	3	4	5	3:HP2 Fill	4:HP2 Floor	Unassigned	
None	547	1,162	973	532	570	474	420	53	4,731
Col %	96.3	96.6	96.9	95.9	86.2	97.5	92.3	85.5	94.7
Chipping	18	33	22	18	23	8	28	8	158
Col %	3.2	2.7	2.2	3.2	3.5	1.6	6.2	12.9	3.2
Indeterminate	3	8	9	5	68	4	7	1	105
Col %	0.5	0.7	0.9	0.9	10.3	0.8	1.5	1.6	2.1
TOTAL	568	1,203	1,004	555	661	486	455	62	4,994

[1] <1/4 in flakes and non-lithics deleted.

Table 3-5. Count of heat treatment by zone, 45-DO-211.

Treatment	Zone								Total[1]
	1	2	3	4	5	3:HP2 Fill	4:HP2 Floor	Unassigned	
None	519	1,124	891	500	565	444	420	57	4,520
Col %	91.4	93.4	88.7	90.1	85.5	91.4	92.3	91.9	90.5
Burned	22	42	53	12	11	13	12	3	168
Col %	3.9	3.5	5.3	2.2	1.7	2.7	2.6	4.8	3.4
Dehydrated	27	37	60	43	85	29	23	2	306
Col %	4.8	3.1	6.0	7.7	12.9	6.0	5.1	3.2	6.1
TOTAL	568	1,203	1,004	555	661	486	455	62	4,994

[1] <1/4 in flakes and non-lithics deleted.

Although cores are present in the collection, examination of the cortex on specimens reveals that most reduction at the site was probably secondary reduction involving the modification of blanks, preforms, and primary flakes created elsewhere (Tables 3-7 and 3-8). Of the objects recovered, 85.2% had no cortex, 10.3% had partial cortex, and only .3% had complete cortex. Of those objects exhibiting cortex, most were made of coarse-grained quartzite (57.8% partial, 21.4% complete). Other locally available stones (fine-grained quartzite, basalt, fine-grained basalt, opal, argillite, granite) comprised 25.6% of the total with partial cortex and 78.5% of the total with complete cortex. Jasper and chalcedony together comprised only 16.2% of the total with partial cortex, and were not recorded with complete cortex. Object types with partial cortex are primarily conchoidal flakes (57.6%) and tabular flakes

Table 3-6. Heat treatment by material type[1] by zone, 45-DO-211.

Material	Zone							Unassigned
	1	2	3	4	5	3;HP2 Fill	4;HP2 Floor	
Jasper								
None	255	529	398	166	54	112	86	39
Burned	18	31	34	6	5	9	3	3
Dehydrated	6	17	14	12	3	-	-	2
Total	279	577	446	184	62	121	89	44
Chalcedony								
None	81	120	125	82	152	93	76	2
Burned	3	10	13	3	4	4	7	-
Total	84	130	138	85	156	97	83	2
Petrified wood								
None	1	2	1	-	-	2	1	1
Total	1	2	1	-	-	2	1	1
Obsidian								
None	2	1	1	-	-	-	-	-
Total	2	1	1	-	-	-	-	-
Opal								
None	65	170	114	75	42	81	46	-
Burned	1	-	4	1	2	-	-	-
Dehydrated	21	20	46	31	82	29	23	-
Total	87	190	164	107	126	110	69	-
Quartzite								
None	77	225	169	121	147	97	161	9
Burned	-	-	-	2	-	-	-	-
Total	77	225	169	123	147	97	161	9
Fine-grained quartzite								
None	7	13	14	15	42	13	6	-
Burned	-	-	1	-	-	-	-	-
Total	7	13	15	15	42	13	6	-
Basalt								
None	5	10	16	12	27	10	13	-
Burned	-	1	-	-	-	-	1	-
Total	5	11	16	12	27	10	14	-
Fine-grained basalt								
None	3	17	16	10	7	18	13	2
Burned	-	-	1	-	-	-	-	-
Total	3	17	17	10	7	18	13	2
Silicized mudstone								
None	-	2	2	2	15	3	6	1
Total	-	2	2	2	15	3	6	1
Argillite								
None	18	24	22	9	2	11	1	1
Total	18	24	22	9	2	11	1	1
Granitic								
None	-	4	5	1	7	1	5	1
Burned	-	-	-	-	-	-	1	-
Total	-	4	5	1	7	1	6	1
Silt/Mudstone								
None	3	6	8	3	68	2	6	1
Total	3	6	8	3	68	2	6	1
Schist								
None	-	-	-	1	-	-	-	-
Total	-	-	-	1	-	-	-	-
Graphite/ molybdenite								
None	-	1	-	-	-	-	-	-
Total	-	1	-	-	-	-	-	-
Indeterminate								
None	2	-	-	3	2	1	-	-
Total	2	-	-	3	2	1	-	-

[1] <1/4 in flakes deleted

(31.2%) (Table 3-9). Those with complete cortex are mainly unmodified types (42.9%), tabular flakes (28.6%) and conchoidal flakes (21.4%).

Table 3-7. Count of dorsal topography by zone, 45-DO-211.

Dorsal Topography	Zone								Total[1]
	1	2	3	4	5	3:HP2 Fill	4:HP2 Floor	Unassigned	
None	514	1,042	873	469	488	439	379	51	4,255
Col %	90.5	86.6	87.0	84.5	73.8	90.3	83.3	82.3	85.2
Part cortex	32	109	89	64	104	38	70	6	512
Col %	5.6	9.1	8.9	11.5	15.7	7.8	15.4	9.7	10.3
Complete cortex	-	7	4	1	-	1	-	1	14
Col %	-	0.6	0.4	0.2	-	0.2	-	1.6	0.3
Indeterminate	22	45	38	21	69	8	6	4	213
Col %	3.9	3.7	3.8	3.8	10.4	1.6	1.3	6.5	4.3
TOTAL	568	1,203	1,004	555	661	486	455	62	4,994

[1] <1/4 in flakes and non-lithics deleted.

Table 3-9. Object type by dorsal topography, 45-DO-211.

Object Type	None	Partial	Complete	Indeterminate	Total[1]
Conchoidal flake	3,346	295	3	77	3,721
Linear flake	9	-	-	-	9
Tabular flake	583	160	4	5	752
Chunk	244	37	-	71	352
Core	5	2	-	1	8
Formed object	66	15	-	6	87
Weathered	-	-	-	6	6
Unmodified	-	3	6	40	49
Indeterminate	2	-	1	7	10
TOTAL	4,255	512	14	213	4,994

[1] <1/4 in flakes and non-lithics deleted.

Although primary reduction may not have been emphasized considerable effort was expended in secondary reduction, as Table 3-10 indicates. Jasper is the most numerous in all flake size categories (>1/4 in = 36%, <1/4 in = 53.5%, <1/8 in = 100%). Quartzite (20%) is next in the >1/4 in category, followed by opal (17%) and chalcedony (15%). In the <1/4 in category, opal (22.9%) is second to jasper, followed by chalcedony (12.6%) and quartzite (6.4%). Cryptocrystalline stones comprise the vast majority of all smaller than 1/4 in flakes, as we would expect given the tractable nature of these stones.

Table 3-8. Kinds of debitage by material by zone, 45-DO-211.

Material Debitage	Zone 1	Zone 2	Zone 3	Zone 4	Zone 5	3:HP2 Fill	4:HP2 Floor	Unassigned	Total[1]
Jasper									
None	258	525	414	167	58	111	86	41	1,660
Part cortex	5	18	9	5	3	6	3	–	49
Indeterminate	16	34	23	12	1	4	–	3	93
Chalcedony									
None	79	119	131	81	149	96	80	2	737
Part cortex	5	10	6	3	6	1	3	–	34
Indeterminate	–	1	1	1	1	–	–	–	4
Petrified wood									
None	1	2	1	–	–	2	1	1	8
Obsidian									
None	2	1	1	–	–	–	–	–	4
Opal									
None	83	182	154	93	125	101	65	–	803
Part cortex	4	8	9	14	1	8	4	–	48
Complete cortex	–	–	1	–	–	–	–	–	1
Indeterminate	–	–	–	–	–	1	–	–	1
Quartzite									
None	62	158	113	87	87	81	112	5	705
Part cortex	14	67	54	32	60	16	49	4	296
Complete cortex	–	1	1	1	–	–	–	–	3
Indeterminate	1	1	1	3	–	–	–	–	6
Fine-grained quartzite									
None	5	11	12	11	25	11	4	–	79
Part cortex	2	1	2	1	17	2	2	–	27
Complete cortex	–	1	–	–	–	–	–	–	1
Indeterminate	–	–	1	–	–	–	–	–	1
Basalt									
None	2	6	10	9	15	6	9	–	57
Part cortex	2	3	4	3	12	3	5	–	32
Complete cortex	–	2	1	–	–	1	–	–	2
Indeterminate	–	–	1	–	–	–	–	–	2
Fine-grained basalt									
None	3	13	16	9	4	18	13	1	77
Part cortex	–	2	1	1	3	–	–	1	8
Complete cortex	–	1	–	–	–	–	–	–	1
Indeterminate	–	1	–	–	–	–	–	–	1
Silicized mudstone									
None	–	2	1	2	15	3	6	–	29
Part cortex	–	–	–	–	–	–	–	1	1
Indeterminate	–	–	1	–	–	–	–	–	1
Argillite									
None	18	24	19	8	2	9	1	1	82
Part cortex	–	–	3	1	–	2	–	–	6
Granitic									
None	–	1	1	–	6	1	2	–	11
Part cortex	–	–	1	1	1	–	4	–	7
Complete cortex	–	2	1	–	–	–	–	1	4
Indeterminate	–	1	2	–	–	–	–	–	3
Silt/mudstone									
None	–	–	–	–	2	–	–	–	2
Indeterminate	3	6	1	3	66	2	8	1	95
Graphite/molybdenite									
Indeterminate	–	1	–	–	–	–	–	–	1
Schist									
None	–	–	–	1	–	–	–	–	1
Indeterminate									
None	1	–	–	1	–	–	–	–	2
Part cortex	–	–	–	–	1	–	–	–	1
Indeterminate	1	–	–	2	1	1	–	–	5
TOTAL	558	1,208	1,004	565	61	486	455	62	4,994

[1] <1/4 in flakes and non-lithics deleted.

Table 3-10. Count of flake size by material by zone, 45-DO-211.

Material	Size (in)	Zone								Total
		1	2	3	4	5	3:HP2 Fill	4:HP2 Floor	Unassigned	
Jasper	>1/4	279	577	446	184	62	121	89	44	1,802
	<1/4	35	90	81	39	10	6	7	7	275
	<1/8	1	-	3	-	-	-	-	-	4
Chalcedony	>1/4	84	130	138	85	156	97	83	2	775
	<1/4	6	20	9	5	7	7	11	-	65
Petrified wood	>1/4	1	2	1	-	-	2	1	1	8
Obsidian	>1/4	2	1	1	-	-	-	-	-	4
	<1/4	-	-	1	-	-	-	-	-	1
Opal	>1/4	87	190	164	107	126	110	69	-	853
	<1/4	11	31	25	40	5	3	3	-	118
Quartzite	>1/4	77	225	169	123	147	97	161	9	1,008
	<1/4	4	12	8	4	1	-	4	-	33
Fine-grained quartzite	>1/4	7	13	15	15	42	13	6	-	111
	<1/4	-	-	-	1	1	-	1	-	3
Basalt	>1/4	5	11	16	12	27	10	14	-	95
	<1/4	-	-	1	-	1	-	-	-	2
Fine-grained basalt	>1/4	3	17	17	10	7	18	13	2	87
	<1/4	-	1	1	-	-	1	-	-	3
Silicized mudstone	>1/4	-	2	2	2	15	3	6	1	31
Argillite	>1/4	18	24	22	9	2	11	1	1	88
	<1/4	5	4	-	3	-	1	-	-	13
Granitic	>1/4	-	4	5	1	7	1	6	1	25
	<1/4	-	-	-	-	1	-	-	-	1
Silt/mudstone	>1/4	3	6	8	3	68	2	6	1	97
Schist	>1/4	-	-	-	1	-	-	-	-	1
Graphite/ molybdenite	>1/4	-	1	-	-	-	-	-	-	1
Indeterminate	>1/4	2	-	-	3	2	1	-	-	8
TOTAL	>1/4	568	1,203	1,004	555	661	486	455	62	4,994
	<1/4	61	158	126	92	26	18	26	7	514
	<1/8	1	-	3	-	-	-	-	-	4

Average weights of recovered material types reflect the pattern of smaller flakes in the cryptocrystalline categories (Table 3-11). Quartzite, basalt, and other coarse-grained, non-cryptocrystalline material weights are far greater than those recorded for cryptocrystalline stones. We also observe this trend in length, width, and thickness measurements taken on conchoidal flakes >1/4 in (Table 3-12). As shown, all three dimensions increase for cryptocrystalline and non-cryptocrystalline materials with the occurrence of partial and complete cortex.

INDUSTRIES

There are two related flake tool industries at 45-DO-211, neither of which required a prepared core, and these are well-represented in all seven zones. The more pervasive was a generalized flake tool industry focused on the production of conchoidal flakes primarily from cryptocrystalline stones. Jasper was the most frequently worked stone, although both chalcedony and opal were commonly utilized. Fine-grained quartzite, basalt, fine-grained basalt, and argillite are also present, but were not frequently worked. Another, related flake tool industry, produced thick, tabular flakes from the local, coarse-grained quartzite. Fracturing in tabular planes, this stone was quickly reduced into usable tool forms by cracking cobbles on the longitudinal axis with a hammerstone. The resultant flakes commonly retain cortex opposite a sharp distal edge; they account for a high percentage of the primary flakes observed in this collection. Commonly, tool forms made of this quartzite were not further reduced beyond resharpening of the working edge of the flake.

We have evidence for all stages of our postulated reductive sequence: cores, primary and secondary flakes, a broad range of debitage, and a variety of formed tools. Consideration of dorsal topography, as well as the relative lack of cores, indicates that most reduction taking place on the site was secondary, resulting in the manufacture of small tool forms from blanks, preforms, and/or primary flakes. The sole exception is the tabular flake industry, which routinely involved primary reduction of the plentiful, locally available quartzite cobbles.

Reduction of cryptocrystalline stones produced 70.7% of the object types, including 72% of all of the tool types identified (Table 3-13). Fine-grained quartzite and basalt comprised only 5.4% of the total number of ojects, and 6.6% of the total number of tool types. The coarse-grained quartzite constituted 18.8% of the total assemblage of object types, and supplied 15.5% of the total number of tool types.

TEMPORAL AND SPATIAL DISTRIBUTION

There is very little change in the nature of stone tool manufacture over the 5,400 year span of occupation documented for 45-DO-211. Nor are the manufacturing techniques represented in the fill (Zone 3:HP2 Fill) and floor (Zone 4:HP2 Floor) of Housepit 2 markedly different from the remainder of Zones 3 and 4. Differences in temporal and spatial distribution consist

Table 3-11. Average weight of concholdally flaked material by zone, 45-DO-211.

Material		Zone 1	Zone 2	Zone 3	Zone 4	Zone 5	Zone 3:HP2 Fill	Zone 4:HP2 Floor	Zone Unassigned	Total[2]
Cryptocrystalline[1]	$\bar{x}$	2.8	3.2	3.2	5.4	3.7	3.7	3.2	3.7	3.5
	s.d.	6.9	13.3	8.3	20.5	8.7	10.8	6.6	6.7	11.7
	n	413	826	658	345	303	301	218	39	3,103
Quartzite	$\bar{x}$	11.4	29.0	23.0	4.9	28.6	8.2	59.6	-	27.6
	s.d.	18.7	63.2	57.2	6.4	82.9	15.5	120.2	-	75.3
	n	15	37	22	18	60	21	32	-	225
Fine-grained quartzite	$\bar{x}$	4.1	3.6	8.5	23.4	13.5	6.8	2.4	-	11.0
	s.d.	4.5	5.0	22.7	74.7	45.3	13.3	3.1	-	39.6
	n	7	11	14	13	39	13	5	-	102
Basalt	$\bar{x}$	4.1	32.4	23.0	15.6	11.8	3.2	19.6	191.0	19.1
	s.d.	4.6	136.4	89.0	50.4	25.7	3.6	75.0	268.7	79.5
	n	7	23	29	22	29	24	23	2	159
Granitic	$\bar{x}$	-	2.0	8.5	-	8.7	1.0	3.2	-	6.1
	s.d.	-	-	10.6	-	11.3	-	2.2	-	8.3
	n	-	1	2	-	6	1	4	-	14
Obsidian	$\bar{x}$	1.0	1.0	-	-	-	-	-	-	1.0
	s.d.	-	-	-	-	-	-	-	-	-
	n	1	1	-	-	-	-	-	-	2
Other	$\bar{x}$	1.7	5.0	3.0	14.2	1.5	13.4	2.0	4.1	5.3
	s.d.	1.4	14.6	6.1	20.6	0.7	30.3	2.0	-	14.6
	n	18	26	22	12	17	13	6	1	115
Indeterminate	$\bar{x}$	4.0	-	-	-	-	-	-	-	4.0
	s.d.	-	-	-	-	-	-	-	-	-
	n	1	-	-	-	-	-	-	-	1
TOTAL	$\bar{x}$	3.0	5.0	4.7	6.8	9.2	4.4	10.7	12.6	5.9
	s.d.	7.5	28.4	22.0	26.0	38.6	12.2	48.4	58.6	28.4
	n	462	925	747	410	474	373	288	42	3,721

[1] Cryptocrystalline includes jasper, chalcedony, petrified wood and opal.

[2] <1/4 in flakes, non-lithics and non-conchoidal flakes deleted.

Table 3-12. Size attributes of cryptocrystalline and other concholdal flakes, 45-DO-211.

Attributes	Zone 1	2	3	4	5	3:HP2 Fill	4:HP2 Floor	Unassigned	Total[1]
Length									
No Cortex									
Cryptocrystalline[2]									
$\bar{x}$	9.5	9.9	10.1	9.8	11.0	10.9	9.6	10.4	10.1
s.d.	4.2	4.9	6.1	5.2	6.4	7.1	6.0	5.1	5.7
n	182	355	305	184	204	182	143	12	1,567
Other									
$\bar{x}$	12.9	9.9	10.0	14.6	9.7	10.0	9.6	-	10.4
s.d.	5.2	3.8	4.2	10.5	4.4	3.9	4.1	-	5.2
n	15	42	34	23	71	40	34	-	259
Total									
$\bar{x}$	9.8	9.8	10.1	10.3	10.7	10.7	9.6	10.4	10.2
s.d.	4.3	4.8	5.9	6.2	6.0	6.6	5.7	5.1	5.7
n	197	397	339	207	275	222	177	12	1,826
Partial Cortex									
Cryptocrystalline									
$\bar{x}$	10.8	13.4	12.9	14.9	21.6	9.5	12.0	-	13.2
s.d.	4.7	5.8	8.5	11.3	8.3	3.6	4.3	-	7.4
n	9	16	11	7	12	7	9	-	77
Other									
$\bar{x}$	16.0	23.5	19.4	20.8	19.0	14.4	23.8	51.0	20.2
s.d.	7.0	16.0	12.0	13.6	13.1	7.6	16.1	-	13.6
n	5	20	19	5	63	16	26	1	155
Total									
$\bar{x}$	12.6	18.7	17.0	16.7	19.3	12.3	20.8	51.0	17.9
s.d.	5.9	13.2	11.2	11.9	12.7	6.6	14.9	-	12.4
n	14	38	30	16	70	28	35	1	232
Cortex									
Cryptocrystalline									
$\bar{x}$	-	-	9.0	-	-	-	-	-	9.0
s.d	-	-	-	-	-	-	-	-	-
n	-	1	1	-	-	-	-	-	1
Other									
$\bar{x}$	-	8.0	-	-	-	-	-	-	8.0
s.d.	-	-	-	-	-	-	-	-	-
n	-	1	-	-	-	-	-	-	1
Total									
$\bar{x}$	-	8.0	9.0	-	-	-	-	-	8.5
s.d.	-	-	-	-	-	-	-	-	0.7
n	-	1	1	-	-	-	-	-	2
Indeterminate									
Cryptocrystalline									
$\bar{x}$	23.0	10.8	10.0	23.5	15.0	11.5	-	-	15.0
s.d.	-	3.2	4.2	11.9	-	4.9	-	-	8.4
n	1	6	2	4	1	2	-	-	16
Total									
$\bar{x}$	23.0	10.8	10.0	23.5	15.0	11.5	-	-	15.0
s.d.	-	3.2	4.2	11.9	-	4.9	-	-	8.4
n	1	6	2	4	1	2	-	-	16

Table 3-12. Cont'd.

Attributes	Zone								Total[1]
	1	2	3	4	5	3:HP2 Fill	4:HP2 Floor	Unassigned	
Thickness									
No Cortex									
Cryptocrystalline									
$\bar{x}$	17.7	17.9	19.4	19.6	19.7	20.0	16.0	21.3	18.7
s.d.	12.4	12.4	14.5	14.6	16.9	15.5	11.9	11.0	13.9
n	305	573	466	258	231	213	169	27	2,242
Other									
$\bar{x}$	21.0	19.3	17.7	22.5	21.4	23.2	19.9	14.0	20.7
s.d.	12.1	14.7	8.6	18.3	13.1	25.4	13.0	-	15.8
n	25	59	47	33	77	49	38	1	329
Total									
$\bar{x}$	18.0	18.1	19.3	19.9	20.2	20.6	16.7	21.0	18.9
s.d.	12.4	12.6	14.1	15.0	16.0	17.7	12.2	10.9	14.2
n	330	632	513	291	308	262	207	28	2,571
Partial Cortex									
Cryptocrystalline									
$\bar{x}$	45.4	35.5	29.5	48.9	43.9	24.4	42.8	-	37.5
s.d.	36.5	23.0	20.9	36.9	22.8	12.3	23.5	-	26.5
n	12	27	15	14	9	14	9	-	100
Other									
$\bar{x}$	34.3	54.5	46.9	40.0	48.3	42.9	55.0	162.0	49.2
s.d.	22.1	37.4	36.1	21.7	36.2	22.8	36.9	-	35.3
n	6	22	22	8	67	16	26	1	168
Total									
$\bar{x}$	41.7	44.0	39.8	45.6	47.7	34.3	51.8	162.0	44.8
s.d.	32.2	31.5	31.7	31.9	34.8	20.5	34.1	-	32.7
n	18	49	37	22	76	30	35	1	268
Cortex									
Cryptocrystalline									
$\bar{x}$	-	-	54.0	-	-	-	-	-	54.0
s.d.	-	-	-	-	-	-	-	-	-
n	-	-	1	-	-	-	-	-	1
Other									
$\bar{x}$	-	21.0	-	-	-	-	-	-	21.0
s.d.	-	-	-	-	-	-	-	-	-
n	-	1	-	-	-	-	-	-	1
Total									
$\bar{x}$	-	21.0	54.0	-	-	-	-	-	37.5
s.d.	-	-	-	-	-	-	-	-	3.3
n	-	1	1	-	-	-	-	-	2
Indeterminate									
Cryptocrystalline									
$\bar{x}$	51.0	36.3	27.4	69.1	44.5	20.5	-	-	43.3
s.d.	22.3	26.8	16.0	41.0	47.4	4.9	-	-	31.9
n	4	13	8	9	2	2	-	-	38
Other									
$\bar{x}$	-	-	-	13.0	-	-	-	-	13.0
s.d.	-	-	-	-	-	-	-	-	-
n	-	-	-	1	-	-	-	-	1
Total									
$\bar{x}$	51.0	36.3	27.4	63.5	44.5	20.5	-	-	42.6
s.d.	22.3	26.8	16.0	42.5	47.4	4.9	-	-	31.8
n	4	13	8	10	2	2	-	-	39

Table 3-12. Cont'd.

Attributes	Zone								Total[1]
	1	2	3	4	5	3:HP2 Fill	4:HP2 Floor	Unassigned	
Width									
No Cortex									
Cryptocrystalline									
$\bar{x}$	8.8	9.2	9.6	9.9	9.9	10.5	8.5	9.1	9.5
s.d.	4.2	5.4	4.7	7.6	5.1	6.1	4.8	2.3	5.4
n	171	336	305	159	188	174	135	14	1,482
Other									
$\bar{x}$	12.4	11.9	9.3	11.6	11.6	12.6	11.3	16.0	11.5
s.d.	6.3	7.8	4.0	5.4	5.6	5.8	7.2	-	6.1
n	17	36	33	18	67	38	33	1	243
Total									
$\bar{x}$	9.1	9.5	9.6	10.1	10.4	10.8	9.1	9.5	9.8
s.d.	4.5	5.7	4.7	7.4	5.3	6.1	5.4	2.9	5.6
n	188	372	333	177	255	212	168	15	1,725
Partial Cortex									
Cryptocrystalline									
$\bar{x}$	14.6	14.0	13.5	17.1	14.4	8.7	19.5	-	14.4
s.d.	7.9	7.3	9.8	13.3	7.2	2.7	13.5	-	9.6
n	9	15	12	12	5	10	8	-	71
Other									
$\bar{x}$	13.0	24.7	24.9	20.6	20.8	17.6	24.2	64.0	21.9
s.d.	5.7	12.4	19.6	4.0	12.2	11.1	19.2	-	14.6
n	5	15	16	5	55	16	2	1	135
Total									
$\bar{x}$	14.0	19.3	20.0	18.1	20.3	14.2	22.9	64.0	19.3
s.d.	7.0	11.4	16.9	11.4	12.0	9.8	17.7	-	13.6
n	14	30	28	17	60	26	30	1	206
Cortex									
Cryptocrystalline									
$\bar{x}$	-	-	16.0	-	-	-	-	-	16.0
s.d.	-	-	-	-	-	-	-	-	-
n	-	-	1	-	-	-	-	-	1
Other									
$\bar{x}$	-	11.0	-	-	-	-	-	-	11.0
s.d.	-	-	-	-	-	-	-	-	-
n	-	1	-	-	-	-	-	-	1
Total									
$\bar{x}$	-	11.0	16.0	-	-	-	-	-	13.5
s.d.	-	-	-	-	-	-	-	-	3.5
n	-	1	1	-	-	-	-	-	2
Indeterminate									
Cryptocrystalline									
$\bar{x}$	10.0	12.0	11.0	23.2	13.0	10.5	-	-	15.2
s.d.	-	4.5	-	10.2	-	2.1	-	-	8.2
n	1	6	1	5	1	2	-	-	16
Total									
$\bar{x}$	10.0	12.0	11.0	23.2	13.0	10.5	-	-	15.2
s.d.	-	4.5	-	10.2	-	2.1	-	-	8.2
n	1	6	1	5	1	2	-	-	16

[1] <1/4 in flakes, non-lithics and non-conchoidal flakes deleted.
[2] Cryptocrystalline includes jasper, chalcedony, petrified wood and opal.

Table 3-13. Count of artifact type by zone by material, 45-DO-211.

Type[1]	Zone								Total[2]
	1	2	3	4	5	3:HP2 Fill	4:HP2 Floor	Unassigned	
Cryptocrystalline[3]									
Projectile point	-	4	-	-	2	1	3	-	10
Projectile point base	2	2	-	-	-	-	1	-	5
Projectile point tip	1	1	-	1	-	-	2	1	6
Biface	4	4	5	3	6	2	2	1	27
Scraper	1	1	-	-	-	-	-	1	3
Tabular knife	-	-	1	-	-	-	-	-	1
Linear flake	1	4	2	2	-	-	-	-	9
Core	-	-	2	2	1	-	1	-	6
Resharpening flake	-	2	-	-	-	-	-	-	2
Bifacially retouched flake	2	1	4	1	4	2	2	-	16
Unifacially retouched flake	3	8	5	4	2	-	3	1	26
Utilized flake	13	23	19	19	16	11	3	2	106
Indeterminate	-	-	-	-	-	1	-	-	1
Conchoidal flake	451	939	752	407	309	306	231	43	3,438
Chunk	25	51	74	21	26	23	14	4	238
Weathered	-	-	-	-	-	-	-	1	1
Subtotal	503	1,040	864	460	366	346	263	54	3,896
Quartzite									
Chopper	-	-	-	-	-	-	-	1	1
Tabular knife	4	8	5	9	3	-	9	2	40
Core	-	-	1	-	-	-	1	-	2
Unifacially retouched flake	-	1	-	-	-	-	-	-	1
Utilized flake	1	-	-	-	-	-	-	-	1
Chunk	-	11	6	4	1	1	6	-	29
Conchoidal flake	16	39	23	20	81	20	34	-	233
Tabular flake	60	177	142	94	63	75	115	6	732
Indeterminate	-	-	-	-	-	1	-	-	1
Subtotal	81	237	177	127	148	97	165	9	1,041
Fine-grained Quartzite									
Bifacially retouched flake	-	-	-	1	-	-	-	-	1
Unifacially retouched flake	-	-	-	-	-	1	-	-	1
Conchoidal flake	7	11	14	14	40	12	6	-	104
Tabular flake	-	2	-	-	-	-	-	-	2
Chunk	-	-	1	1	3	-	1	-	6
Subtotal	7	13	15	16	43	13	7	-	114
Basalt									
Projectile point	-	-	1	-	-	-	1	-	2
Chopper	-	-	-	-	1	1	1	-	3
Peripherally flaked cobble	-	-	-	-	2	-	2	-	4
Tabular knife	-	1	-	-	-	-	-	-	1
Hammerstone	-	1	-	-	-	-	-	-	1
Millingstone	-	-	-	-	-	1	-	-	1

Table 3-13. Cont'd.

Type	Zone 1	Zone 2	Zone 3	Zone 4	Zone 5	3:HP2 Fill	4:HP2 Floor	Unassigned	Total
Basalt									
Bifacially retouched flake	-	-	-	-	2	-	-	-	2
Unifacially retouched flake	-	-	1	-	-	-	-	-	1
Utilized flake	-	1	2	-	-	-	-	-	3
Conchoidal flake	7	24	29	22	30	25	23	2	162
Chunk	-	1	1	-	-	1	-	-	3
Tabular flake	-	-	-	-	-	1	-	-	1
Weathered	1	1	1	-	-	-	-	-	3
Subtotal	8	29	35	22	35	29	27	2	187
Granitic									
Chopper	-	-	-	-	1	-	-	-	1
Peripherally flaked cobble	-	-	1	1	-	-	1	-	3
Anvil	-	1	-	-	-	-	-	-	1
Hammerstone	-	1	-	-	-	-	-	1	2
Millingstone	-	-	1	-	-	-	-	-	1
Conchoidal flake	-	1	2	-	7	1	4	-	15
Chunk	-	-	-	-	-	-	1	-	1
Weathered	-	1	-	-	-	-	-	-	1
Indeterminate	-	-	1	-	-	-	-	-	1
Subtotal	-	4	5	1	8	1	6	1	26
Obsidian									
Projectile point tip	1	-	-	-	-	-	-	-	1
Conchoidal flake	1	1	1	-	-	-	-	-	3
Tabular flake	-	-	1	-	-	-	-	-	1
Subtotal	2	1	2	-	-	-	-	-	5
Other									
Projectile point	-	-	1	-	-	1	-	-	2
Projectile point tip	-	-	-	-	-	-	1	-	1
Chopper	-	-	-	-	-	-	-	1	1
Resharpening flake	-	1	-	-	-	-	-	-	1
Utilized flake	-	-	-	1	-	1	-	-	2
Conchoidal flake	23	29	22	14	17	13	6	1	125
Chunk	-	-	1	-	-	-	-	-	1
Indeterminate	3	7	8	3	68	2	6	1	98
Subtotal	26	37	32	18	85	17	13	3	231
Indeterminate									
Millingstone	-	-	-	-	-	-	1	-	1
Bead	-	-	-	1	-	1	-	-	2
Utilized flake	-	-	-	-	1	-	-	-	1
Conchoidal flake	1	-	-	-	-	-	-	-	1
Chunk	1	-	-	-	-	-	-	-	1
Indeterminate	-	1	-	2	1	-	-	-	4
Subtotal	2	1	-	3	2	1	1	-	10
Total	629	1,361	1,130	647	687	504	481	69	5,508

[1] See discussion of functional object types in Functional Analysis section.
[2] 1/8" flakes and non-lithics deleted.
[3] Cryptocrystalline includes jasper, chalcedony, petrified wood and opal.

entirely of shifts in the relative proportions of attributes across zonal assemblages.

We do note that jasper is most frequent in sitewide Zones 1, 2 and 3, and that it decreases in frequency in Zones 4 and 5, where chalcedony, opal, quartzite, fine-grained quartzite, and basalt, all show corresponding increases. Jasper also comprises a somewhat lower percentage of the total in Housepit 2 floor and fill, where once again, these other material types show corresponding increases. Quartzite, in particular, is substantially more common in the housepit floor. Any inference about this subtle change in material preference over time must, however, be tempered by the relatively small size of assemblages from Zones 4, 5, and Houusepit 2, as compared to those from Zone 2 and 3. Nevertheless, there does appear to be shift toward a greater use of jasper in those zones dated after ca. 2700 B.P. and extending up into late pre-contact or historic period.

Other aspects of the technological assemblage reflect the higher percentages of quartzite in the Housepit 2 floor. Tabular flakes increase, as do the distribution of primary flakes, and the weight of flakes. The number of formed objects increases slightly, in keeping with the higher density of tool forms that we might expect from a house floor.

These differences in relative frequency among zones may represent the loci of specific economic activities; this seems particularly likely for the increase of tabular flakes on the floor of Housepit 2. It is evident that manufacturing techniques are remarkably consistent over time at this site. Cryptocrystalline stones supplied most of the tools used. Quartzite cobbles were a handy source for simple tabular flakes. Although primary reduction of all of these stones probably took place on the site, it seems most likely that stones other than the coarse-grained quartzite were usually partially reduced elsewhere and only finished on the site. A shift in the preference of jasper over other cryptocrystalline stones may have occurred, but this certainly was not accompanied by any change in the generalized flake tool industry present from 5400 B.P. on into the pre-contact period.

FUNCTIONAL ANALYSIS

Functional analysis examines the physical characteristics of artifacts in order to identify patterns of wear diagnostic of specific tool uses. Past research has pointed out the possibility of interpreting tool use by examining edge damage and general attrition of working surfaces (e.g., Crabtree 1973; Frison 1968; Hayden 1979; Keeley 1978, 1974; Odell 1977; Stafford and Stafford 1979; Semenov 1964; Wilmsen 1968, 1970). Wear patterns have been shown to reveal both the manner of tool use and the nature of the materials worked.

All artifacts were examined with a 10X hand-lens (cf. Hayden 1979; Stafford and Stafford 1979). During analysis, each artifact was classified as to tool shape, wear or surface damage, and edge angle. Making use of established correlations between specific wear patterns on certain materials and types of tool use, we can hypothesize the intended and actual use of collected tools. Most distinctions will be based on hardness--on the nature of edge attrition given softer and harder working mediums.

Eight classificatory dimensions are used to describe functional attributes: UTILIZATION-MODIFICATION, CONDITION OF WEAR, WEAR/MANUFACTURE RELATIONSHIP, KIND OF WEAR, LOCATION OF WEAR, SHAPE OF WORN AREA, ORIENTATION OF WEAR, and EDGE ANGLE. The first dimensions describes objects, the next six describe tools on objects, and the last describes variation within object/tool types through measurement of the working edges. Table 3-14 outlines these dimensions and constituent attributes.

Table 3-14. Functional dimensions.

DIMENSION I: UTILIZATION/MODIFICATION

- None
- Wear only
- Manufacture only
- Manufacture and wear
- Modified/indeterminate
- Indeterminate

DIMENSION II: TYPE OF MANUFACTURE

- None
- Chipping
- Pecking
- Grinding
- Chipping and pecking
- Chipping and grinding
- Pecking and grinding
- Chipping, pecking, grinding
- Indeterminate/not applicable

DIMENSION III: MANUFACTURE DISPOSITION

- None
- Partial
- Total
- Indeterminate/not applicable

DIMENSION IV: WEAR CONDITION

- None
- Complete
- Fragment

DIMENSION V: WEAR/MANUFACTURE RELATIONSHIP

- None
- Independent
- Overlapping - total
- Overlapping - partial
- Independent - opposite
- Indeterminate/not applicable

DIMENSION VI: KIND OF WEAR

- Abrasion/grinding
- Smoothing
- Crushing/pecking
- Polishing

DIMENSION VI: Continued

- Feathered chipping
- Feathered chipping/abrasion
- Feathered chipping/smoothing
- Feathered chipping/crushing
- Feathered chipping/polishing
- Hinged chipping
- Hinged chipping/abrasion
- Hinged chipping/smoothing
- Hinged chipping/crushing
- Hinged chipping/polishing
- None

DIMENSION VII: LOCATION OF WEAR

- Edge only
- Unifacial edge
- Bifacial edge
- Point only
- Point and unifacial edge
- Point and bifacial edge
- Point and any combination
- Surface
- Terminal surface
- None

DIMENSION VIII: SHAPE OF WORN AREA

- Not applicable
- Convex
- Concave
- Straight
- Point
- Notch
- Slightly convex
- Slightly concave
- Irregular

DIMENSION IX: ORIENTATION OF WEAR

- Not applicable
- Parallel
- Oblique
- Perpendicular
- Diffuse
- Indeterminate

DIMENSION X: OBJECT EDGE ANGLE

- Actual edge angle

Description will initially focus on functional object types. Object-specific dimensions record the occurrences of wear and manufacture on functional object types. Tool-specific dimensions explicate the kinds of wear observed. Analysis will therefore proceed from the object to examination of tools on the object. Summary tables will deal with tools and the attributes of wear and manufacture which characterize them, rather than with simple descriptions of traditional formal-functional categories.

FUNCTIONAL OBJECT TYPES

The functional object types are traditionally used formal categories based on technological, morphological, and functional characteristics. We have attempted to apply these labels in a manner consistent with past usage: however, variations in how the terms have been used prevents universal comparability. For example, what we have called millingstones--rocks with crushing wear on a convex surface--some researchers would term hopper mortar bases. We have limited the use of the latter term to rocks with crushing wear on concave surfaces.

A total of 302 stone tools were recovered from site 45-DO-211 (Table 3-15). These tools encompass a broad range of functional forms, including light piercing and cutting tools, cruder cutting, scraping, and chopping tools, heavy pounding implements, and large grinding stones. Plates 3-1 through 3-4 illustrate various classes of tools recovered from 45-DO-211: scrapers, unifacially and bifacially retouched flakes and bifaces (Plate 3-1); large chopping, cutting and pounding tool forms (Plate 3-2); and cores (Plate 3-3). Chipping is the only kind of manufacture identified on functional object types in the collection, although several instances of indeterminate wear on millingstones and beads probably represent pecking and grinding (Tables 3-16 and 3-17). Wear patterns show a range of uses in combination with attributes of manufacture, from wear only on utilized flakes, cores, linear flakes, hammerstones and anvils to interrelated patterns of wear and manufacture on retouched and resharpened flakes, tabular knives, scrapers, peripherally flaked cobbles, choppers, and assorted other formed object types.

The small assemblage of worked bone from 45-DO-211 includes an antler wedge (Plate 3-4a) from Zone 5, and a bone needle (Plate 3-4b) from Zone 4. Several long bone fragments in Zones 4 and 5 have flaking along the edges: whether this attrition is due to deliberate use or modification or is related to butchering and marrow extraction has not been conclusively determined. The single shell artifact, a dentalium bead (Plate 3-4c), is from Zone 4. These artifacts are not listed in Table 3-15 or subsequent tables, and are not discussed in the following sections. As the functional analyses were oriented toward lithics they provide no additional information about these artifact types.

WEAR PATTERNS

Simple utilized, retouched, and resharpened flake tools show a marked consistency in wear pattern, with feathered and hinged chipping wear on unifacial edges the primary characteristic (Table 3-18). Indeed, the

Table 3-15. Functional object types sorted by zone, 45-DO-211.

Artifact	Zone																Total[1]
	1		2		3		4		5		3:HP2 Fill		4:HP2 Floor		Unassigned		
	N	Col %	N	Col %	N	Col %	N	Col %	N	Col %	N	Col %	N	Col %	N	Col %	
Projectile point	-	-	4	0.3	2	0.2	-	-	2	0.3	2	0.4	4	0.9	-	-	14
Projectile point base	2	0.4	2	0.2	-	-	-	-	-	-	-	-	1	0.2	-	-	5
Projectile point tip	2	0.4	1	0.1	-	-	1	0.2	-	-	-	-	3	0.7	1	1.6	8
Biface	4	0.7	4	0.3	5	0.5	3	0.5	6	0.9	2	0.4	2	0.4	1	1.6	27
Chopper	-	-	-	-	-	-	-	-	2	0.3	1	0.2	1	0.2	2	3.2	6
Flaked cobble	-	-	-	-	1	0.1	1	0.2	2	0.3	-	-	3	0.7	-	-	7
Scraper	1	0.2	1	0.1	-	-	-	-	-	-	-	-	-	-	1	1.6	3
Tabular Knife	4	0.7	9	0.7	6	0.6	9	1.6	3	0.5	-	-	9	2.0	2	3.2	42
Bead	-	-	-	-	-	-	1	0.2	-	-	1	0.2	-	-	-	-	2
Anvil	-	-	1	0.1	-	-	-	-	-	-	-	-	-	-	-	-	1
Hammerstone	-	-	2	0.2	-	-	-	-	-	-	-	-	-	-	1	1.6	3
Millingstone	-	-	-	-	1	0.1	-	-	-	-	1	0.2	1	0.2	-	-	3
Linear flake	1	0.2	4	0.3	2	0.2	2	0.4	-	-	-	-	-	-	-	-	9
Core	-	-	-	-	3	0.3	2	0.4	1	0.2	-	-	2	0.4	-	-	8
Resharpening flake	-	-	3	0.2	-	-	-	-	-	-	-	-	-	-	-	-	3
Bifacially retouched	2	0.4	1	0.1	4	0.4	2	0.4	6	0.9	2	0.4	2	0.4	-	-	19
Unifacially retouched	3	0.5	9	0.7	6	0.6	4	0.7	2	0.3	1	0.2	3	0.7	1	1.6	29
Utilized	14	2.5	24	2.0	21	2.1	20	3.6	17	2.6	12	2.5	3	0.7	2	3.2	113
Indeterminate	3	0.5	8	0.7	9	0.9	3	0.5	68	10.3	4	0.8	6	1.3	1	1.6	101
None	532	93.7	1,130	93.9	944	94.0	507	91.4	552	83.5	460	94.7	415	91.2	50	80.6	4,590
TOTAL	563		1,203		1,004		555		662		486		455		62		4,994

1 <1/4 in flakes and non-lithics deleted.

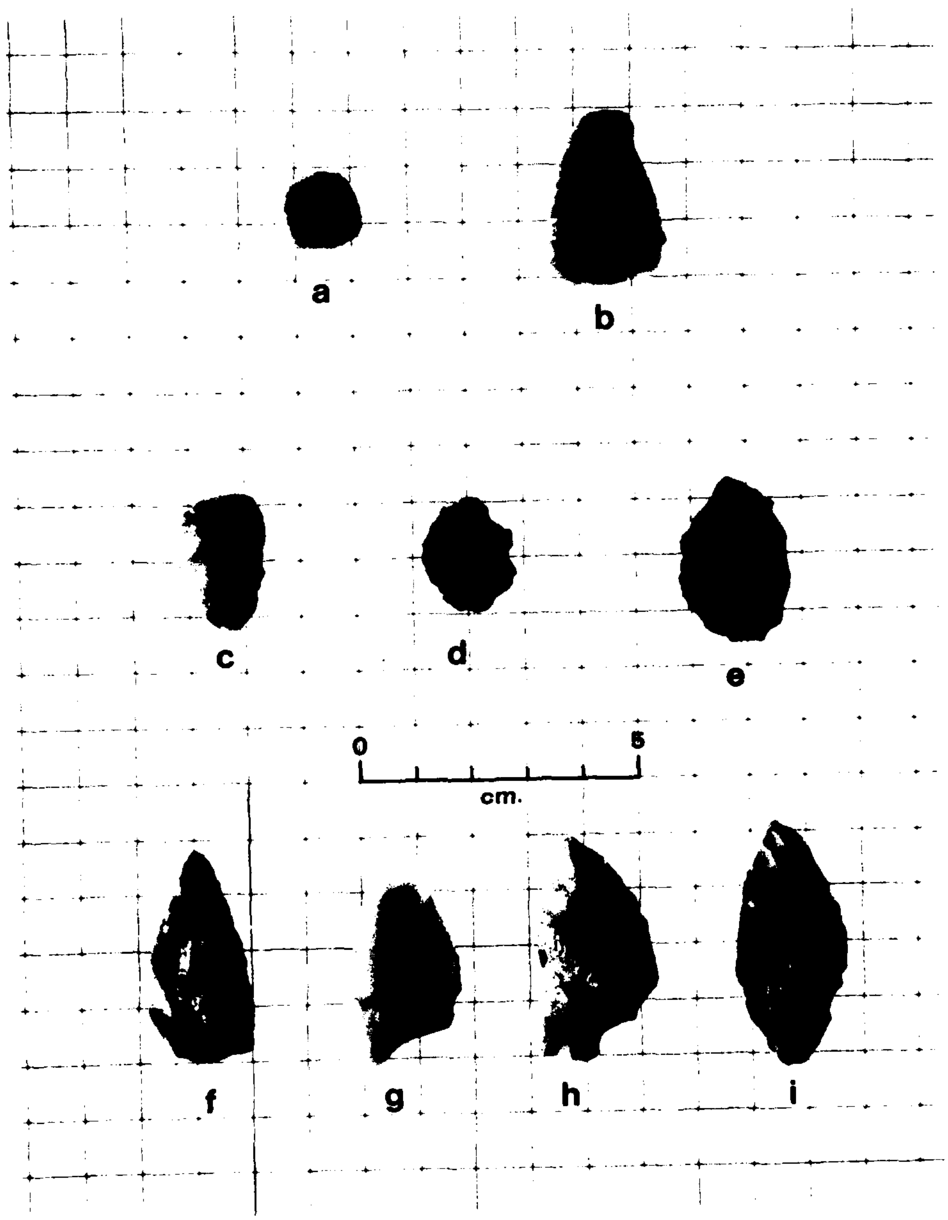
KEY	Master Number: Tool: Provenience/Level: Zone: Material:

a.	b.		
49 Scraper 22N14E/10 - Jasper	35 Scraper 12N4E/30 1 Chalcedony		

c.	d.	e.	
362 Unifacially retouched flake 55N23W/10 1 Chalcedony	19 Biface Testing/60A - Cryptocrystalline	311 Biface 61N26W/FE41/80 4 Chalcedony	

f.	g.	h.	i.
8 Biface Testing/60B - Cryptocrystalline	403 Bifacially retouched flake 55N26W/110 3 Chalcedony	393 Biface 56N25W/130 4 Opal	277 Biface 60N26W/80 4 Opal

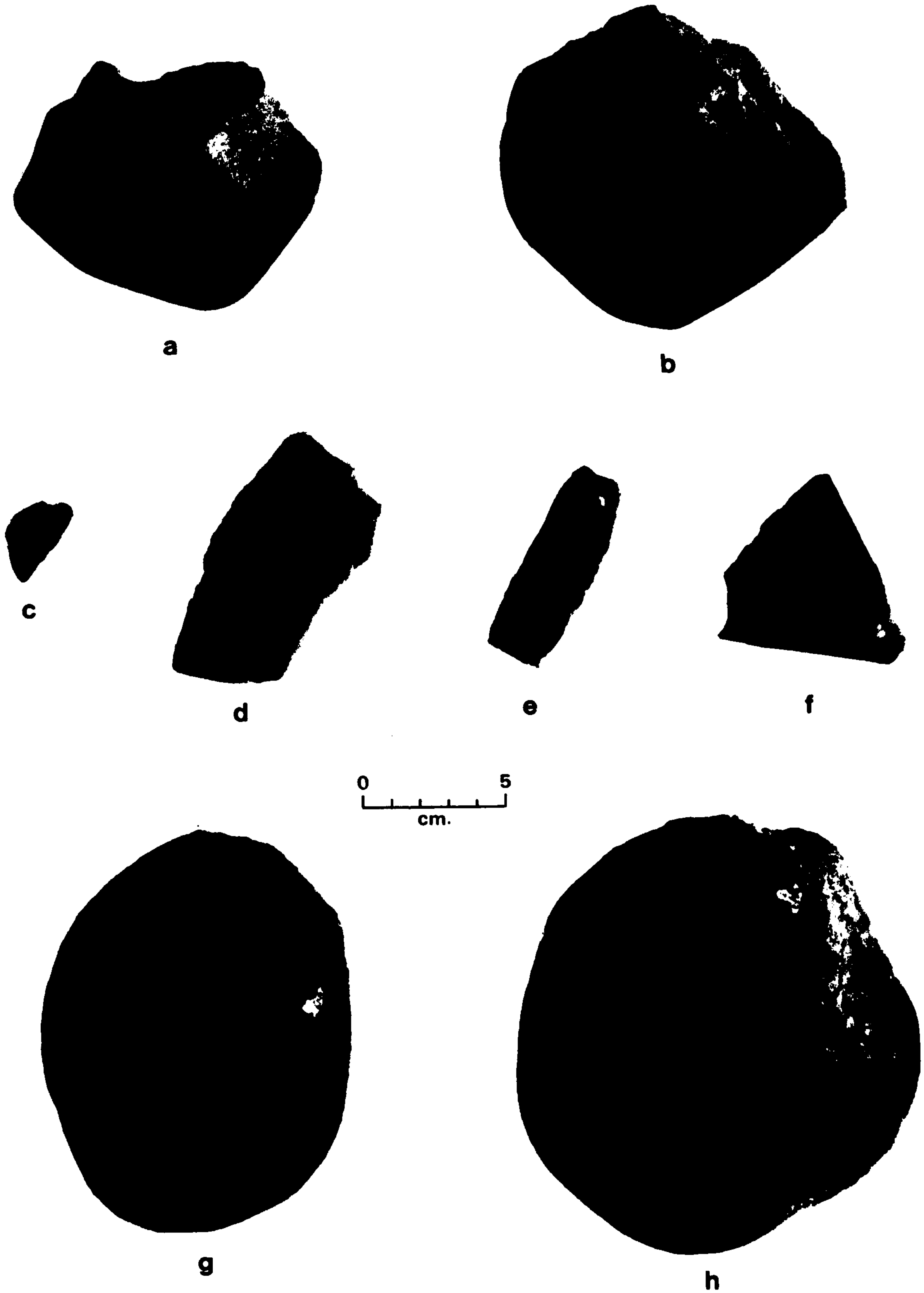
Plate 3-1. Scrapers, unifacially and bifacially retouched flakes and bifaces, 45-DO-211.


a
b
c
d
e
0
5
cm.
f
g
h
i

KEY	Master Number: Tool: Provenience/Level: Zone: Material:

a.	b.		
498 Chopper 32N16E/ FE2,10/20 - Silicized mudstone	53 Chopper 22N14E/ FE2,10/40 - Coarse-grained quartzite		
c.	**d.**	**e.**	**f.**
221 Tabular knife 58N24W/ FE13,57/120 4 Coarse-grained quartzite	14 Tabular knife Testing/140A - Quartzite	222 Tabular knife 58N23W/ FE13,57/130 4 Coarse-grained quartzite	341 Tabular knife 54N25W/160 1 Coarse-grained quartzite
g.	**h.**		
47 Hammerstone 12N15E/FE6/50 2 Granite	54 Hammerstone 22N15E/ FE10,2/50 - Granite		

Plate 3-2. Large chopping, cutting and pounding tool forms, 45-DO-211.


a
b
c
d
e
f
0
5
cm.
g
h

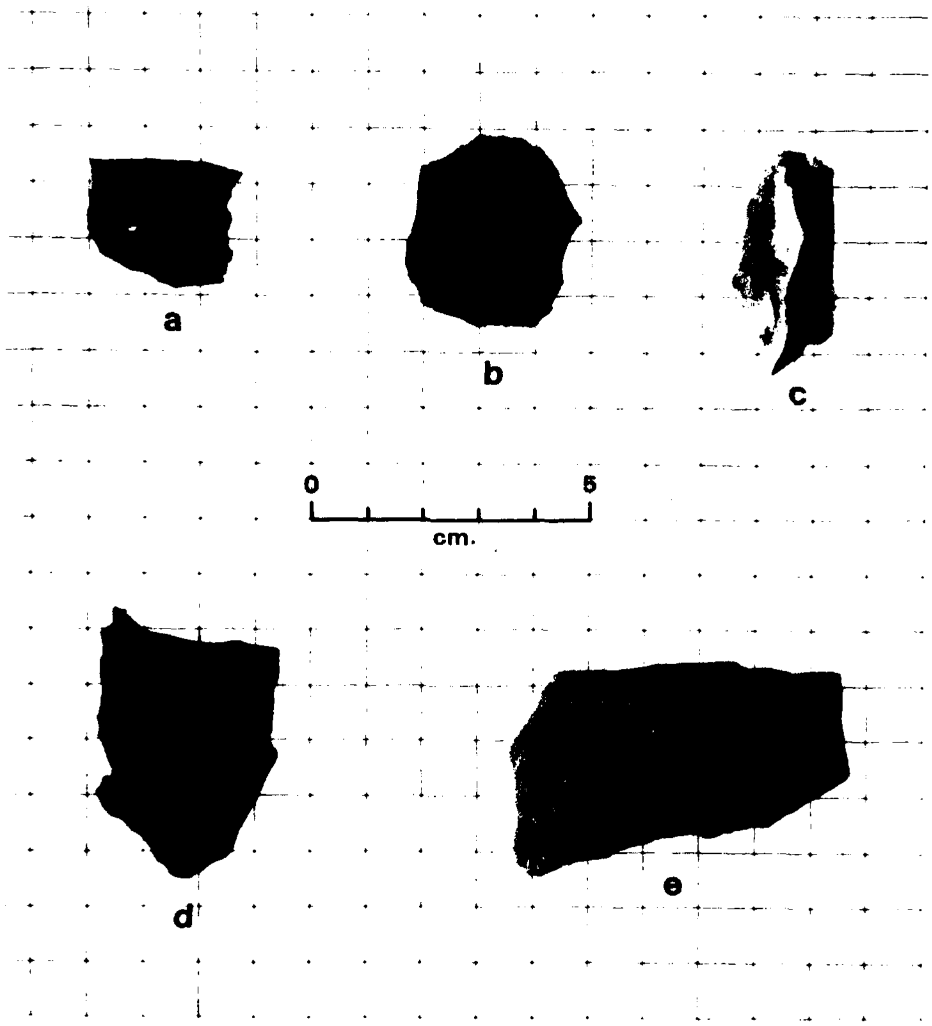
KEY

Master Number:
Tool:
Provenience/Level:
Zone:
Material:

a.	b.	c.
399	239	212
Core	Core	Core
55N26W/60	57N28W/120	56N21W/80
3	4	4
Chalcedony	Chalcedony	Jasper

d.	e.
334	340
Core	Core
53N24W/FE14/160	54N25W/160
5	4
Jasper	Coarse-grained quartzite

Plate 3-3. Cores, 45-DO-211.


a
b
c
0
5
cm.
d
e

KEY

Master Number:
Tool:
Provenience/Level:
Zone:
Material:

a.
325
Wedge
53N25W/FE56/150
5
Bone/Antler

b.
383
Needle
55N23W/FE20/145
4
Bone/Antler

c.	d.	e.	f.
176	34	180	331
Dentalium	Bead	Bead	Bead
2N11E/140	Testing/140A	2N11E/FE28/160	54N24W/120
4	-	4	3
Dentalium	Slate	Indeterminate	Indeterminate

Plate 3-4. Bone, shell, and ground stone artifacts, 45-DO-211.

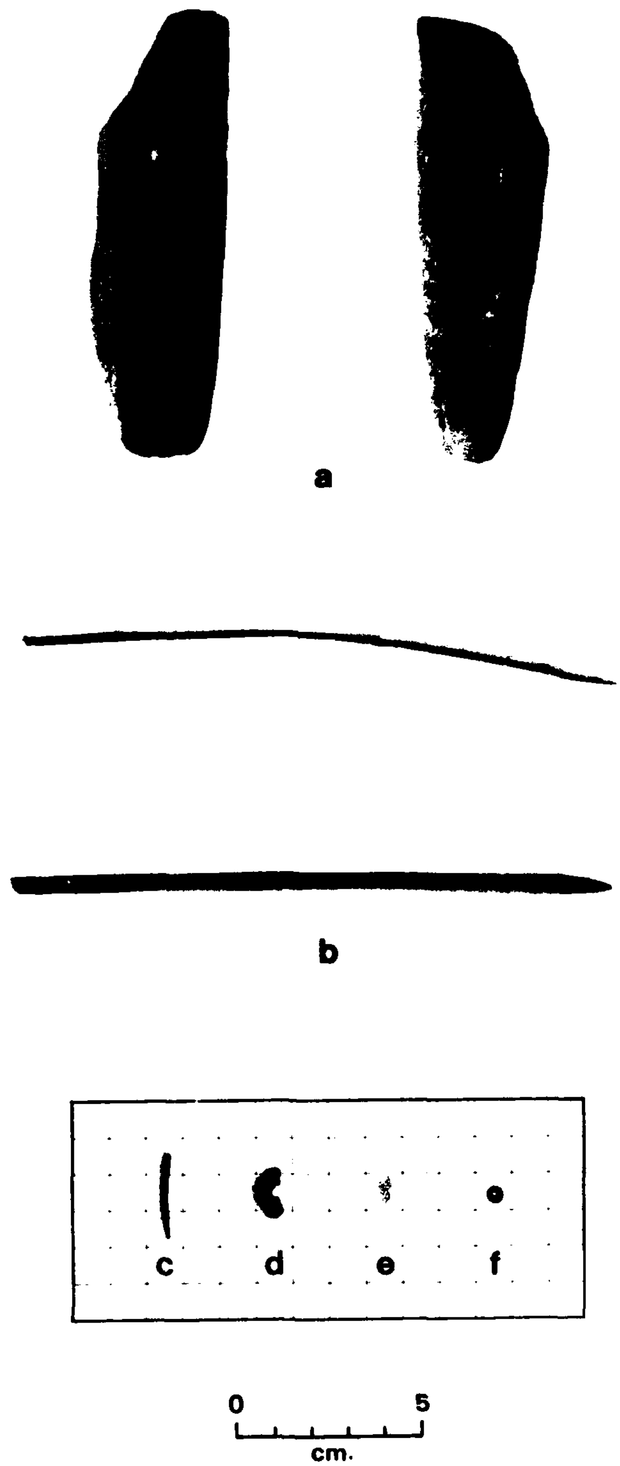

a
b
c
d
e
f
0
5
cm.

Table 3-16. Use and manufacture characteristics of formed objects by zone, 45-DO-211.

Type	UM[1]	TM[2]	Zone							
			1	2	3	4	5	3:HP2 Fill	4:HP2 Floor	Unassigned
Projectile point	3	2	–	3	1	–	2	1	4	–
Projectile point	4	2	–	1	1	–	–	1	–	–
Projectile point base	3	2	1	2	–	–	–	–	1	–
Projectile point base	4	2	1	–	–	–	–	–	–	–
Projectile point tip	3	2	2	1	–	1	–	–	2	–
Projectile point tip	4	2	–	–	–	–	–	–	1	1
Biface	3	2	3	3	3	2	6	2	2	1
Biface	4	2	1	1	2	1	–	–	1	–
Chopper	3	2	–	–	–	–	1	1	1	–
Chopper	4	2	–	–	–	–	1	–	–	2
Peripherally flaked cobble	3	2	–	–	1	–	1	–	2	–
Peripherally flaked cobble	4	2	–	–	–	–	1	–	1	–
Peripherally flaked cobble	5	9	–	–	–	1	–	–	–	–
Scraper	4	2	1	1	–	–	–	–	–	1
Tabular knife	2	1	–	1	3	1	–	–	–	–
Tabular knife	3	2	1	2	–	2	–	–	1	–
Tabular knife	4	2	3	6	3	6	3	–	8	2
Bead	5	9	–	–	–	1	–	1	–	–
TOTAL			13	21	14	15	15	6	24	7

[1]UM= Utilization/modification
1. none
2. wear only
3. manufacture only
4. manufacture and wear
5. modified/indeterminate
6. indeterminate

[2]TM = Type of manufacture
1. none
2. chipping
3. pecking
4. grinding
5. chipping and pecking
6. chipping and grinding
7. pecking and grinding
8. chipping, pecking, grinding
9. indeterminate

Table 3-17. Number of other modified objects by zone, 45-DO-211.

Type	UM[1]	TM[2]	Zone							
			1	2	3	4	5	3:HP2 Fill	4:HP2 Floor	Unassigned
Anvil stone	2	1	–	1	–	–	–	–	–	–
Hammerstone	2	1	–	2	–	–	–	–	–	1
Millingstone	2	1	–	–	–	–	–	1	–	–
Millingstone	4	2	–	–	1	–	–	–	–	–
Millingstone	6	9	–	–	–	–	–	–	1	–
Linear flake	1	1	1	4	1	2	–	–	–	–
Linear flake	2	1	–	–	1	–	–	–	–	–
Core	1	1	–	–	3	2	–	–	1	–
Core	2	1	–	–	–	–	1	–	1	–
Resharpening flake	3	2	–	1	–	–	–	–	–	–
Resharpening flake	4	2	–	2	–	–	–	–	–	–
Bifacially retouched flake	3	2	–	1	3	–	3	–	1	–
Bifacially retouched flake	4	2	2	–	1	2	3	2	1	–
Unifacially retouched flake	3	2	–	2	1	1	–	1	–	–
Unifacially retouched flake	4	2	3	7	5	3	2	–	3	1
Utilized flake	2	1	14	24	21	20	17	12	3	2
Indeterminate	2	1	–	–	–	–	–	1	–	–
Indeterminate	5	9	3	7	9	3	68	3	6	1
TOTAL			23	51	46	33	94	20	17	5

[1]UM = Utilization/modification
1. none
2. wear only
3. manufacture only
4. manufacture and wear
5. modified/indeterminate
6. indeterminate

[2]TM = Type of Manufacture
1. none
2. chipping
3. pecking
4. grinding
5. chipping and pecking
6. chipping and grinding
7. pecking and grinding
8. chipping, pecking, grinding
9. indeterminate

Table 3-18. Functional type and wear area paradigm, 45-DO-211.

Type/Wear	Zone								Total
	1	2	3	4	5	3:HP2 Fill	4:HP2 Floor	Unassigned	
Projectile Point									
Kind of Wear									
Smoothing	-	-	-	-	-	1	-	-	1
Feathered chipping	1	-	2	-	-	-	-	-	3
Feathered chipping/smoothing	-	-	-	-	-	-	1	3	4
Hinged chipping	-	-	1	-	-	-	-	-	1
Hinged chipping/smoothing	-	1	-	-	-	-	-	-	1
Location of Wear									
Unifacial edge	1	-	3	-	-	-	-	-	4
Bifacial edge	-	-	-	-	-	-	-	3	3
Point and two edges	-	1	-	-	-	1	1	-	3
Grouped Edge Angle									
31-60 degrees	1	1	2	-	-	1	-	3	8
>60 degrees	-	-	1	-	-	-	1	-	2
Biface									
Kind of Wear									
Feathered chipping	1	-	2	-	-	-	-	-	3
Feathered chipping/smoothing	1	2	-	-	-	-	1	-	4
Hinged chipping	-	-	1	-	-	-	-	-	1
Hinged chipping/smoothing	-	-	-	2	-	-	-	-	2
Location of Wear									
Unifacial edge	2	-	1	-	-	-	-	-	3
Bifacial edge	-	2	2	2	-	-	-	-	6
Point bifacial	-	-	-	-	-	-	1	-	1
Grouped Edge Angle									
1-30 degrees	-	-	1	-	-	-	-	-	1
30-60 degrees	1	2	2	2	-	-	1	-	8
>60 degrees	1	-	-	-	-	-	-	-	1
Chopper									
Kind of Wear									
Smoothing	-	-	-	-	-	-	-	1	1
Crushing/Pecking	-	-	-	-	1	-	-	1	2
Location of Wear									
Unifacial edge	-	-	-	-	-	-	-	1	1
Bifacial edge	-	-	-	-	1	-	-	1	2
Grouped Edge Angle									
>60 degrees	-	-	-	-	1	-	-	2	3
Scraper									
Kind of Wear									
Smoothing	-	1	-	-	-	-	-	-	1
Feathered chipping	-	-	-	-	-	-	-	3	3
Hinged chipping/smoothing	3	-	-	-	-	-	-	-	3
Location of Wear									
Unifacial edge	3	1	-	-	-	-	-	3	7
Grouped Edge Angle									
31-60 degrees	3	-	-	-	-	-	-	3	6
>60 degrees	-	1	-	-	-	-	-	-	1

Table 3-18. Cont'd.

Type/Wear	Zone								Total
	1	2	3	4	5	3:HP2 Fill	4:HP2 Floor	Unassigned	
Tabular Knife									
Kind of Wear									
Smoothing	3	9	4	7	4	–	9	2	38
Feathered chipping/smoothing	–	–	–	1	–	–	–	–	1
Hinged chipping	–	–	1	–	–	–	–	–	1
Hinged chipping/smoothing	–	–	1	–	–	–	–	–	1
Location of Wear									
Edge only	2	8	3	7	4	–	9	2	35
Unifacial edge	–	–	2	1	–	–	–	–	3
Bifacial edge	1	1	1	–	–	–	–	–	3
Grouped Edge Angle									
1-30 degrees	1	5	2	2	–	–	4	–	14
31-60 degrees	2	3	4	6	3	–	5	2	25
>60 degrees	–	1	–	–	1	–	–	–	2
Hammerstone									
Kind of Wear									
Crushing/Pecking	–	2	–	–	–	–	–	2	4
Location of Wear									
Terminal surface	–	2	–	–	–	–	–	2	4
Grouped Edge Angle									
Surface	–	2	–	–	–	–	–	2	4
Millingstone									
Kind of Wear									
Crushing/pecking	–	–	1	–	–	1	–	–	2
Location of Wear									
Surface	–	–	1	–	–	1	–	–	2
Grouped Edge Angle									
Surface	–	–	1	–	–	1	–	–	2
Anvil									
Kind of Wear									
Crushing/pecking	–	1	–	–	–	–	–	–	1
Location of Wear									
Surface	–	1	–	–	–	–	–	–	1
Grouped Edge Angle									
Surface	–	1	–	–	–	–	–	–	1
Peripherally Flaked Cobble									
Kind of Wear									
Smoothing	–	–	–	–	–	–	1	–	1
Feathered chipping/smoothing	–	–	–	–	2	–	–	–	2
Location of Wear									
Edge only	–	–	–	–	–	–	1	–	1
Bifacial edge	–	–	–	–	2	–	–	–	2
Grouped Edge Angle									
>60 degrees	–	–	–	–	2	–	1	–	3

Table 3-18. Cont'd.

Type/Wear	Zone								Total
	1	2	3	4	5	3:HP2 Fill	4:HP2 Floor	Unassigned	
Core									
Kind of Wear									
Feathered chipping/smoothing	-	-	-	-	1	-	-	-	1
Hinged chipping	-	-	-	-	1	-	1	-	2
Location of Wear									
Unifacial edge	-	-	-	-	2	-	1	-	3
Grouped Edge Angle									
>60 degrees	-	-	-	-	2	-	1	-	3
Linear Flake									
Kind of Wear									
Feathered chipping	-	-	1	-	-	-	-	-	1
Location of Wear									
Unifacial edge	-	-	1	-	-	-	-	-	1
Grouped Edge Angle									
1-30 degrees	-	-	1	-	-	-	-	-	1
Resharpening Flake									
Kind of Wear									
Feathered chipping	-	2	-	-	-	-	-	-	2
Location of Wear									
Unifacial edge	-	2	-	-	-	-	-	-	2
Grouped Edge Angle									
31-60 degrees	-	1	-	-	-	-	-	-	1
>60 degrees	-	1	-	-	-	-	-	-	1
Bifacial Retouched Flake									
Kind of Wear									
Smoothing	-	-	-	1	-	-	-	-	1
Feathered chipping	2	-	1	1	1	1	-	-	6
Feathered chipping/smoothing	1	-	-	-	1	-	-	-	2
Hinged chipping	1	-	1	-	3	2	-	-	7
Hinged chipping/smoothing	1	-	-	-	-	-	2	-	3
Location of Wear									
Edge only	-	-	-	1	-	-	-	-	1
Unifacial edge	4	-	1	1	2	-	2	-	10
Bifacial edge	-	-	1	-	3	2	-	-	6
Point only	1	-	-	-	-	-	-	-	1
Point and two edges	-	-	-	-	-	1	-	-	1
Grouped Edge Angle									
1-30 degrees	1	-	-	1	-	-	1	-	3
31-60 degrees	3	-	2	1	4	3	1	-	14
>60 degrees	-	-	-	-	1	-	-	-	1
Indeterminate	1	-	-	-	-	-	-	-	1

Table 3-18. Cont'd.

Type/Wear	Zone								Total
	1	2	3	4	5	3:HP2 Fill	4:HP2 Floor	Unassigned	
Unifacially Retouched Flake									
Kind of Wear									
Smoothing	1	1	-	-	-	-	-	-	2
Feathered chipping	1	3	1	7	1	-	2	2	17
Feathered chipping/smoothing	-	-	1	2	-	-	-	-	3
Hinged chipping	2	9	2	5	-	-	3	-	21
Hinged chipping/smoothing	2	-	3	-	1	-	3	-	9
Location of Wear									
Edge only	-	1	-	-	-	-	-	-	1
Unifacial edge	5	10	7	12	1	-	5	2	42
Bifacial edge	-	2	-	1	1	-	2	-	6
Point only	1	-	-	-	-	-	-	-	1
Point unifacial	-	-	-	1	-	-	-	-	1
Point and two edges	-	-	-	-	-	-	1	-	1
Grouped Edge Angle									
1-30 degrees	1	2	-	-	-	-	1	1	5
31-60 degrees	5	8	6	10	2	-	6	1	38
>60 degrees	-	3	1	4	-	-	1	-	9
Utilized Only									
Kind of Wear									
Smoothing	-	-	1	1	1	1	-	-	4
Feathered chipping	13	28	14	20	15	13	1	2	106
Feathered chipping/abrasion	-	-	-	1	-	-	-	-	1
Feathered chipping/smoothing	1	1	2	1	3	1	-	-	9
Hinged chipping	4	1	7	2	8	2	3	1	28
Hinged chipping/smoothing	-	-	1	-	4	-	-	-	5
Location of Wear									
Edge only	-	-	1	-	1	1	-	-	3
Unifacial edge	16	29	20	22	25	14	4	3	133
Bifacial edge	2	1	4	2	5	2	-	-	16
Point and two edges	-	-	-	1	-	-	-	-	1
Grouped Edge Angle									
1-30 degrees	9	14	13	11	9	9	2	-	67
31-60 degrees	7	14	9	10	14	7	2	2	65
>60 degrees	2	2	3	4	8	1	-	1	21
Indeterminate									
Kind of Wear									
Abrasion/grinding	-	1	-	-	-	1	-	-	2
Crushing/pecking	-	-	1	-	-	-	-	-	1
Location of Wear									
Unifacial edge	-	1	-	-	-	-	-	-	1
Bifacial edge	-	-	1	-	-	-	-	-	1
Surface	-	-	-	-	-	1	-	-	1
Grouped Edge Angle									
1-30 degrees	-	1	-	-	-	-	-	-	1
>60 degrees	-	-	1	-	-	-	-	-	1
Surface	-	-	-	-	-	1	-	-	1

occurrence of retouching of an edge, whether unifacial or bifacial, is strongly associated with wear on unifacial edges. The occurrence of wear on points and edges, and combinations thereof, indicate that these tools had multiple uses. One pattern may functionally segregate these tool forms: a strong tendency for utilized only flakes to exhibit feathered chipping wear, and unifacially and bifacially retouched flakes to have heavier hinged chipping and hinged chipping-smoothing wear. This suggests that utilized only flakes, selected for a sharp edge and not retouched or resharpened, were used for light cutting tasks, while the retouched flakes were used for heavier, deeper cutting where the tool came into contact with bone and gristle.

More extensively formed cutting, scraping, and piercing tools (scrapers, bifaces, tabular knives, and projectile points) show about the same range of uses as the simple flake tools, but exhibit greater functional differences among tool types. Scrapers have predominantly feathered chipping and hinged chipping-smoothing wear on unifacial edges. Bifaces have primarily feathered chipping and feathered chipping-smoothing wear on bifacial as well as unifacial edges. Tabular knives show almost entirely smoothing wear on edges only. Projectile points tend to have feathered chipping and feathered chipping-smoothing wear, but exhibit all other kinds of wear, and display these on unifacial edges, bifacial edges, and point and edge combinations. While examination of Table 3-18 shows that all four formed tool types exhibit about the same range of uses, these distinctions do seem to highlight some different use patterns. Despite their label, scrapers seem to have been used frequently for light to heavy cutting operations requiring a strong unifacial edge very like the retouched flake tools. Bifaces seem to have functioned as knives, and were used primarily for light cutting as well as for heavier, deeper cutting, probably in order to dismember large game carcasses. It may be significant that wear extends onto bifacial edges as well as unifacial edges. The label "tabular knife" is an apparent misnomer, given the almost exclusive presence of smoothing wear on edges only. This would indicate that tabular knives were used to scrape hides or other soft materials. Projectile points were obviously used for a wide spectrum of activities; clearly, their use was not confined to dart or arrow points. Wear and wear location indicate uses covering the range noted for scrapers, bifaces, tabular knives, and simple flake tools.

Large cutting, pounding, and grinding tools are characterized by a very different set of wear patterns--crushing-pecking wear on unifacial and bifacial edges and terminal surfaces and surfaces--, in keeping with traditional functional labels. The small assemblage of these tool forms consists of six choppers, three hammerstones, three millingstones, and one anvil. Their wear patterns, however, indicate uses ranging from rough butchering or woodworking to bone maceration, lithic reduction, or plant processing. Related functional forms include cores and peripherally flaked cobbles used for cutting or chopping activities in hard materials.

WEAR AREA-OBJECT RATIOS

Scrapers and unifacially retouched flakes show the highest wear area ratios of any stone tools in the collection. Simple utilized and retouched flakes exhibit the widest range of multiple tools on an object--from one to seven isolable wear areas (Table 3-19). These patterns indicate that simple flake tools, retouched or not, were frequently used and were the most reused tool form. The high wear area ratio for scrapers may actually indicate the use pattern for that tool form, or, as likely, be a function of the very limited sample (two artifacts). Although tabular knives have a relatively high wear area ratio, they exhibit a range of multiple tools far more restricted than that seen in the simple conchoidal flake tool forms: most specimens have only one and never more than two wear areas. This may be the result of tabular quartzite's abundance in the project area; there would be little reason to husband such artifacts. Somewhat surprisingly, bifaces and projectile points showed few instances of wear and very low wear area ratios, perhaps indicating that these tools were used on softer materials or, perhaps, that simple flake tools were used for most jobs. Other tools are represented by too few specimens to permit us to assess use patterns. Most noteworthy is the relative absence of wear on the four choppers, particularly since we have an abundance of smashed bone fragments in these collections indicative of marrow and grease extraction.

The wear area ratios are distributed fairly evenly across the defined analytic zones especially if we consider the low frequencies in most cells in the table. Temporal/spatial differences are largely a matter of the presence or absence of specific tool forms. Projectile points, simple utilized and retouched flakes, and tabular knives are found in all seven zones, reflecting the pervasive emphasis on hunting-butchering-processing activities throughout the span of site occupation. Large chopping tools and millingstones are not found in the uppermost zones at the site; they are most common in Zone 5, and in the Housepit 2 fill and on the floor. Conversely, scrapers, resharpened flakes, hammerstones, and the single anvil recorded are confined to the two uppermost zones. Discrete zonal clusters consist solely of the hammerstones, the single anvil, and the resharpened flakes confined to Zone 2.

EDGE ANGLE DISTRIBUTIONS

Measurement of edge angles within these general tool classes gives us another method of evaluating the function of different tool forms and differences in the activities represented within the defined zones (Appendix B, Tables B-1, B-2, B-3). Figures 3-1 and 3-2 illustrate edge angle distributions for selected functional tool types and attributes of wear only and wear and manufacture. Because many artifact types are present in low numbers, their distributions have been left in tabular form.

Consideration of edge angle distribution for simple flake tools supports the inferences drawn from the wear data. Utilized only flakes show a distribution skewed toward an acute edge angle in the range 16-40°, indicating that these tools were selected for their sharp cutting edge; little emphasis

Table 3-19. Frequency of worn areas by functional type, 45-DO-211.

Functional Type[1]	Number of Wear Areas	Zone														Wear/Area Ratio
		1		2		3		4		5		3:HP2 Fill		4:HP2 Floor		
		Freq	Ratio	Freq	Ratio	Freq	Ratio	Freq	Ratio	Freq	Ratio	Freq	Ratio	Freq	Ratio	
Utilized flake	1	11	18/14	22	30/24	18	25/21	15	25/20	8	31/17	9	17/12	2	4/3	150/111
	2	2	=1.28	-	=1.25	2	=1.19	5	=1.25	5	=1.82	2	=1.42	1	=1.33	=1.35
	3	1	-	1	-	1	-	-	-	3	-	-	-	-	-	-
	4	-	-	-	-	-	-	-	-	1	-	1	-	-	-	-
	5	-	-	1	-	-	-	-	-	-	-	-	-	-	-	-
Unifacially retouched flake	-	-	6/3	2	13/9	1	7/6	1	14/4	-	2/2	1	0/1	-	8/3	50/28
	1	1	=2.00	2	=1.44	3	=1.17	-	=3.50	2	=1.00	-	-	-	=2.67	=1.78
	2	1	-	4	-	2	-	-	-	-	-	-	-	2	-	-
	3	1	-	1	-	-	-	1	-	-	-	-	-	-	-	-
	4	-	-	-	-	-	-	1	-	-	-	-	-	1	-	-
	7	-	-	-	-	-	-	1	-	-	-	-	-	-	-	-
Bifacially retouched flake	-	-	5/2	1	0/1	3	2/4	-	2/2	3	5/6	-	3/2	1	2/2	19/19
	1	1	=2.5	-	-	-	=.50	2	=1.00	1	=.83	1	=1.50	-	=1.00	=1.00
	2	-	-	-	-	1	-	-	-	2	-	1	-	1	-	-
	4	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Resharpening flake	-	-	-	1	2/3	-	-	-	-	-	-	-	-	-	-	2/3
	1	-	-	2	=.67	-	-	-	-	-	-	-	-	-	-	=.67
Linear flake	-	1	0/1	4	0/4	1	1/2	2	0/2	-	-	-	-	-	-	1/9
	1	-	-	-	-	1	=.50	-	-	-	-	-	-	-	-	=.11
Tabular knife	-	1	3/4	2	9/9	-	6/6	2	8/9	-	4/3	-	-	1	9/9	39/40
	1	3	=.75	5	=1.00	6	=1.00	6	=.89	2	=1.33	-	-	7	=1.00	=.97
	2	-	-	2	-	-	-	1	-	1	-	-	-	1	-	-
Biface	-	3	2/4	3	2/4	3	3/5	2	2/3	6	0/6	2	0/2	2	1/3	10/27
	1	-	=.50	-	=.50	1	=.60	-	=.67	-	-	-	-	1	=.33	=.37
	2	1	-	1	-	1	-	1	-	-	-	-	-	-	-	-
Scraper	1	-	3/1	1	1/1	-	-	-	-	-	-	-	-	-	-	4/2
	3	1	=3.00	-	=1.00	-	-	-	-	-	-	-	-	-	-	=2.00
Projectile points and fragments	-	3	1/4	8	1/7	1	3/2	1	0/1	2	0/2	1	1/2	7	1/8	7/26
	1	1	=.25	1	=.14	-	=1.50	-	-	-	-	1	=.50	1	=.12	=.27
	3	-	-	-	-	1	-	-	-	-	-	-	-	-	-	-
Chopper	-	-	-	-	-	-	-	-	-	1	1/2	1	0/1	1	0/1	1/4
	1	-	-	-	-	-	-	-	-	1=.50		-	-	-	-	=.25
Hammerstone	1	-	-	2	2/2	-	-	-	-	-	-	-	-	-	-	2/2
	2	-	-	-	=1.00	-	-	-	-	-	-	-	-	-	-	=1.00
Millingstone	-	-	-	-	-	-	1/1	-	-	-	-	-	1/1	1	0/1	2/3
	1	-	-	-	-	1	=1.00	-	-	-	-	1	=1.00	-	-	=.67
Anvil	1	-	-	1	1/1	-	-	-	-	-	-	-	-	-	-	1/1
					=1.00											=1.00
Peripherally flaked cobble	-	-	-	-	-	1	0/1	1	0/1	1	2/2	-	-	2	2/3	4/7
	2	-	-	-	-	-	-	-	-	1	=1.00	-	-	1	=.67	=.57
Core	-	-	-	-	-	3	0/3	2	0/2	-	2/1	-	-	1	2/2	4/8
	2	-	-	-	-	-	-	-	-	1	=2.00	-	-	1	=1.00	=.50
Indeterminate	-	3	0/3	6	1/7	8	1/9	3	0/3	88	0/88	3	1/4	6	0/6	3/100
	1	-	-	1	=.14	1	=.11	-	-	-	-	1	=.25	-	-	=.03

[1] Beads and bone tools have not been included.

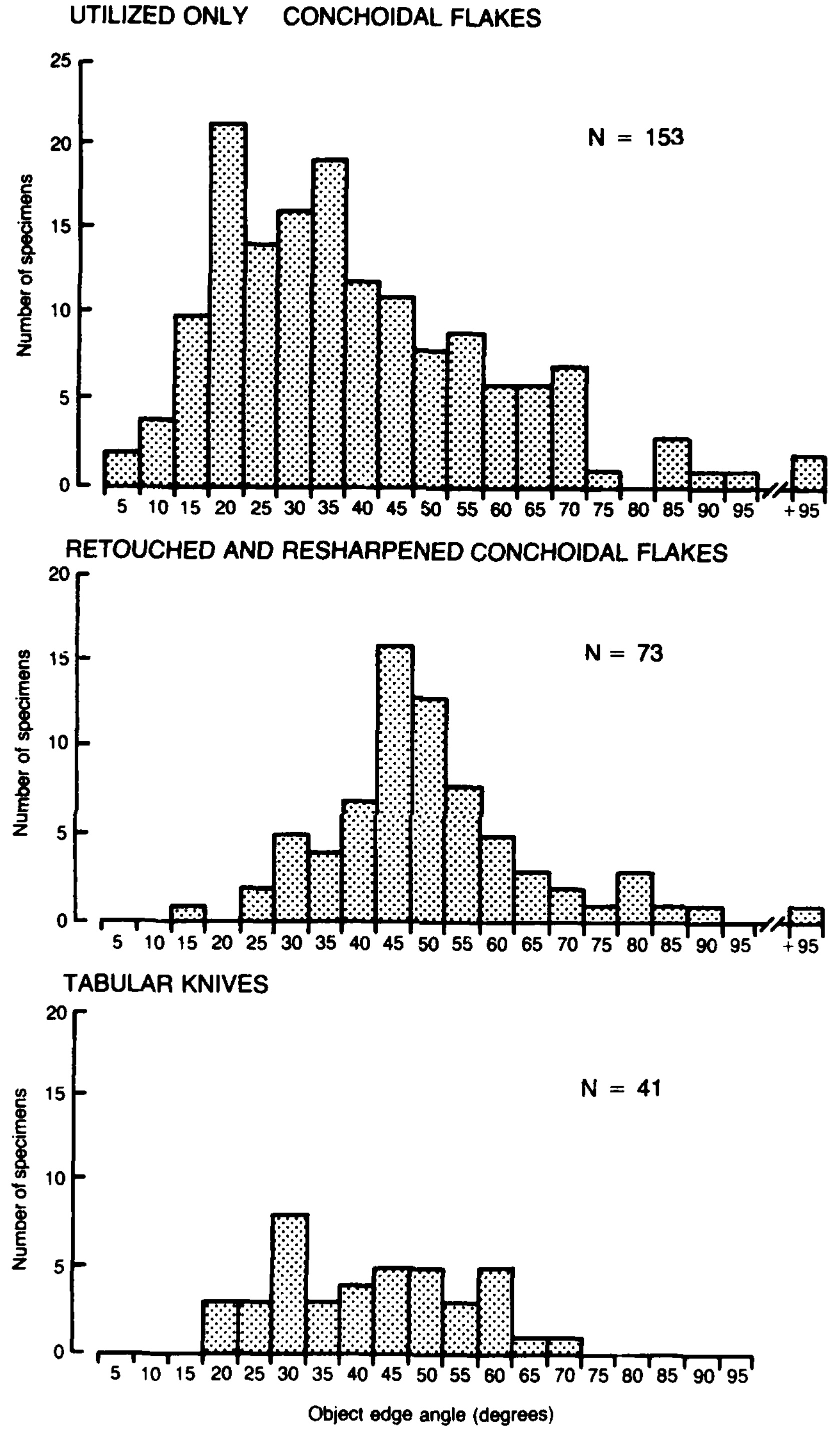


Figure 3-1. Edge angle distribution of utilized only conchoidal flakes, retouched and resharpened conchoidal flakes and tabular knives, 45-DO-211.

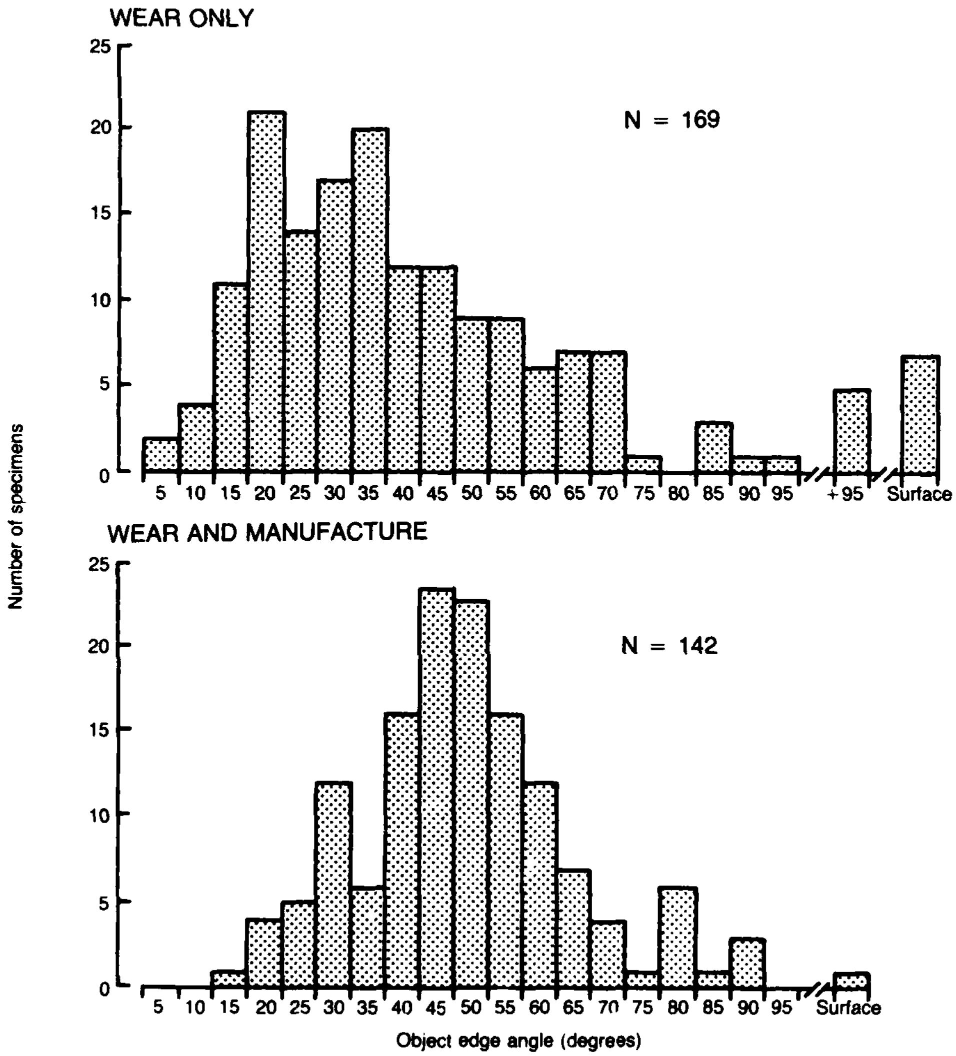


Figure 3-2. Edge angle distributions of tools classified as wear only and wear and manufacture, 45-DO-211.

was placed on durability. Retouched and resharpened flakes exhibit a more regular distribution, with a peak in a less acute edge angle range (41-50°), evidence perhaps of more concern with creation or maintenance of a more durable edge. Tabular knives, however, have a very uniform distribution, evidencing little or no concern with the acuteness of the edge over a broad range from 16° to at least 65°. This agrees with the characteristic wear pattern identified for tabular knives--smoothing on a unifacial edge--and affirms our conclusion that they were used primarily as scrapers or fleshers.

Our histograms showing edge angle distributions of tools which exhibit wear only or wear and manufacture clearly reflect distribution trends noted for the three flake tool classes. Incorporating measurements from all functional types defined at the site, excepting those coded as indeterminate in the dimension UTILIZATION-MODIFICATION, these histograms show a wear only distribution skewed toward more acute edge angles in the range 16-35°, and a more normal wear and manufacture distribution centered in the range 35-60°. This suggests that knappers consciously sought a desired tool form and were concerned with its durability. They commonly selected sharp flakes for light cutting tasks; more often than not they would discard them upon completion of a task. More specialized tool forms (e.g., projectile points or scrapers) show less acute edge angles and more attention to maintenance and reuse. A concern with durability in these tool forms appears to be reflected in the less acute edge angle range and more normal frequency distribution.

ECONOMIC PATTERNS

The vast majority of all tool types are indicative of cutting, scraping, piercing, and chopping uses commonly associated with hunting-butchering-processing of game (92.7%, N=280). We do not dispute that some of these tool forms may also have been used in the processing of plant parts or wood: the antler wedge certainly indicates wood working at the site. However, kinds of wear and locations of wear on lithic tools are more characteristic of light and heavy cutting, scraping and crushing activities on meat, hides and bone. Feathered and hinged chipping wear, often in conjunction with smoothing wear, primarily on unifacial edges, on simple flakes tools, bifaces, and projectile points, certainly evidence hunting, and working of hunting-related by-products. Smoothing wear on tabular knives and scrapers indicate the scraping and fleshing of hides or other soft, oily materials. Crude choppers and hammerstones, as well as a single anvil, in association with systematically crushed artiodactyl bone, are most likely evidence of primary butchering and attendant processing of bones for marrow and grease, although it is likely that these artifacts were used to reduce wood or stone as well. The three millingstones clearly evidence grinding of seeds or other plant parts; and other tools may well have been used to process plant stuffs as well as carcasses. Finally, the single bone point recovered from Zone 2 may be indicative of fishing, an activity obviously engaged in by the site inhabitants. Numbers of salmonid, cyprinid, and catostomid bone were recovered from most zones at the site (Chapter 4).

Analysis of functional tool types leads us to postulate that hunting of game animals was the main economic focus during most occupations at the site; this was supplemented by the gathering of plant foods and fishing.

TEMPORAL AND SPATIAL PATTERNS

The distribution of functional object types shows some interesting patterns (Table 3-15). Simple flake tools, conchoidal or tabular, are the most frequent tool forms in all seven zones. Projectile points and bifaces are also found in all zones, although these never make up more than 2% of any zonal assemblage. Scrapers, the single anvil, and hammerstones are confined to Zones 1 and 2. Conversely, choppers, peripherally flaked cobbles, and cores occur in all zones save 1 and 2. Millingstones occur only in Zone 3 and in the Housepit 2 fill and floor. Therefore, although site economy in all zones appears to have been largely oriented toward hunting, there are specific tool forms that indicate different aspects of that economy in different temporal periods. The presence of millingstones in Zones 3 and Zone 4, which contains four housepits, suggests a greater role for plant processing during long-term periods of occupation.

Zonal differences, then, involve the presence or absence of functional types, rather than discernible changes in the use pattern or intensity of use of particular tool types. When comparable tools are present in the zones, they exhibit virtually identical wear patterns and have about equal proportions of kinds of wear and locations of wear. Therefore, we must conclude that there is no indication of a significant change in the broad range of tools present on the site over time nor in the use of comparable tools over time.

A high proportion of projectile points and projectile point fragments, peripherally flaked cobbles, tabular knives, and millingstones on the floor of Housepit 2 suggests that artifacts found on bounded activity surfaces saw greater and more prolonged use in conjunction with a range of subsistence activities. This is especially marked if we consider the much smaller volume of site deposit removed as housepit floor compared to Zone 4 or the overlying fill (Table 2-2). Since Housepit 2 was the only well-defined and extensively excavated structure, it may be that the uniformity in the spatial distribution of tools and associated use patterns is directly related to the lack of defined living surfaces. If we had been able to excavate more activity surfaces within each zone or across a single zone, particularly Zone 4 which contained the largest artifact assemblage and the most complex occupation stratigraphy, we might be able to observe variation in the site economy over short periods, perhaps even seasons, and also detect differences in the spatial distribution of activities. Nevertheless, the remarkable uniformity in distributions of tool types and uses of comparable tool types allows us to conclude that site economy in all periods of occupation emphasized hunting, butchering, and processing of game, supplemented by plant collection and processing, and fishing.

STYLISTIC ANALYSIS

The only artifact type from 45-DO-211 which was subjected to stylistic analysis is projectile points. The analyses developed for the entire project is described briefly below, followed by results of its application to the 45-DO-211 assemblage.

PROCEDURES

Two separate but conceptually related analyses are used to classify projectile points. A morphological classification is used to define descriptive types that do not directly correspond to recognized historical types. This is intended as an independent check on the temporal distribution of projectile point forms in the Rufus Woods Lake project area and as a means to measure the distribution of formal attributes as well as point styles. An historical classification correlates these projectile points with recognized types that have discrete temporal distributions. A multivariate statistical program which compares line and angle measurements taken along the outlines of the points is used to classify the specimens. Together, these analyses allow us to (1) assess formal and temporal variation in our collection without first imposing prior typological constructs, (2) correlate specimens recovered from our study area with those found elsewhere on the Columbia Plateau in a consistent, verifiable manner, (3) develop a typology that incorporates both qualitative and quantitative scales of measurement, and (4) examine the temporal significance of specific formal attributes as well as aggregates viewed as ideal types.

Eleven classificatory dimensions have been defined for morphological classification: BLADE/STEM JUNCTURE, OUTLINE, STEM EDGE ORIENTATION, SIZE, BASAL EDGE SHAPE, BLADE EDGE SHAPE, CROSS SECTION, SERRATION, EDGE GRINDING, BASAL EDGE THINNING, and FLAKE SCAR PATTERN. Of these, the first four (DI-DIV) define eighteen morphological types. The other seven serve to describe these types more fully, and permit the identification of variants within the types. Table 3-20 outlines these dimensions and associated attributes.

By defining the margins of projectile points, we are able to place them within one of the eighteen morphological types. This is done by drawing straight lines from nodes where the outline of the specimen changes direction. Figure 3-3 illustrates the technique. For a corner-notched triangular point, the blade is defined as line segment $\overline{a\text{-}A}$. The shoulder is line segment $\overline{A\text{-}1}$. The neck is node 1. The stem is line segment $\overline{1\text{-}2}$. The base is line segment $\overline{2\text{-}a'}$. Terms applied and the number of line segments drawn vary given the two basic subdivisions of form. Lanceolates are generally defined by four or less line segments ($\overline{aA12}$). Stemmed triangular forms are defined by five or less line segments ($\overline{aA123}$). Side-notched triangular forms are defined by five or more line segments ($\overline{aA12345}$). Table 3-21 lists the eighteen morphological types with descriptions, classification codes, and line segment definitions.

Cross-tabulation of classificatory dimensions DV-DXI supplies detailed descriptions of the eighteen morphological types and allows us to assess the temporal distribution of formal attributes as well as that of point styles.

Table 3-20. Dimensions of morphological projectile point classification.

DIMENSION I: BLADE-STEM JUNCTURE

- N. Not separate
- 1. Side-notched
- 2. Shouldered
- 3. Squared
- 4. Barbed
- 9. Indeterminate

DIMENSION II: OUTLINE

- N. Not applicable
- 1. Triangular
- 2. Lanceolate
- 9. Indeterminate

DIMENSION III: STEM EDGE ORIENTATION

- N. Not applicable
- 1. Straight
- 2. Contracting
- 3. Expanding
- 9. Indeterminate

DIMENSION IV: SIZE

- N. Not applicable
- 1. Large
- 2. Small

DIMENSION V: BASAL EDGE SHAPE

- N. Not applicable
- 1. Straight
- 2. Convex
- 3. Concave
- 4. Point
- 5. 1 or 2 and notched
- 9. Indeterminate

DIMENSION VI: BLADE EDGE SHAPE

- N. Not applicable
- 1. Straight
- 2. Excurvate
- 3. Incurvate
- 4. Reworked
- 9. Indeterminate

DIMENSION VII: CROSS SECTION

- N. Not applicable
- 1. Planoconvex
- 2. Biconvex
- 3. Diamond
- 4. Trapezoidal
- 9. Indeterminate

DIMENSION VIII: SERRATION

- N. Not applicable
- 1. Not serrated
- 2. Serrated
- 9. Indeterminate

DIMENSION IX: EDGE GRINDING

- N. Not applicable
- 1. Not ground
- 2. Blade edge
- 3. Stem edge
- 9. Indeterminate

DIMENSION X: BASAL EDGE THINNING

- N. Not applicable
- 1. Not thinned
- 2. Short flake scars
- 3. Long flake scars
- 9. Indeterminate

DIMENSION XI: FLAKE SCAR PATTERN

- N. Not applicable
- 1. Variable
- 2. Uniform
- 3. Mixed
- 4. Collateral
- 5. Transverse
- 6. Other
- 9. Indeterminate

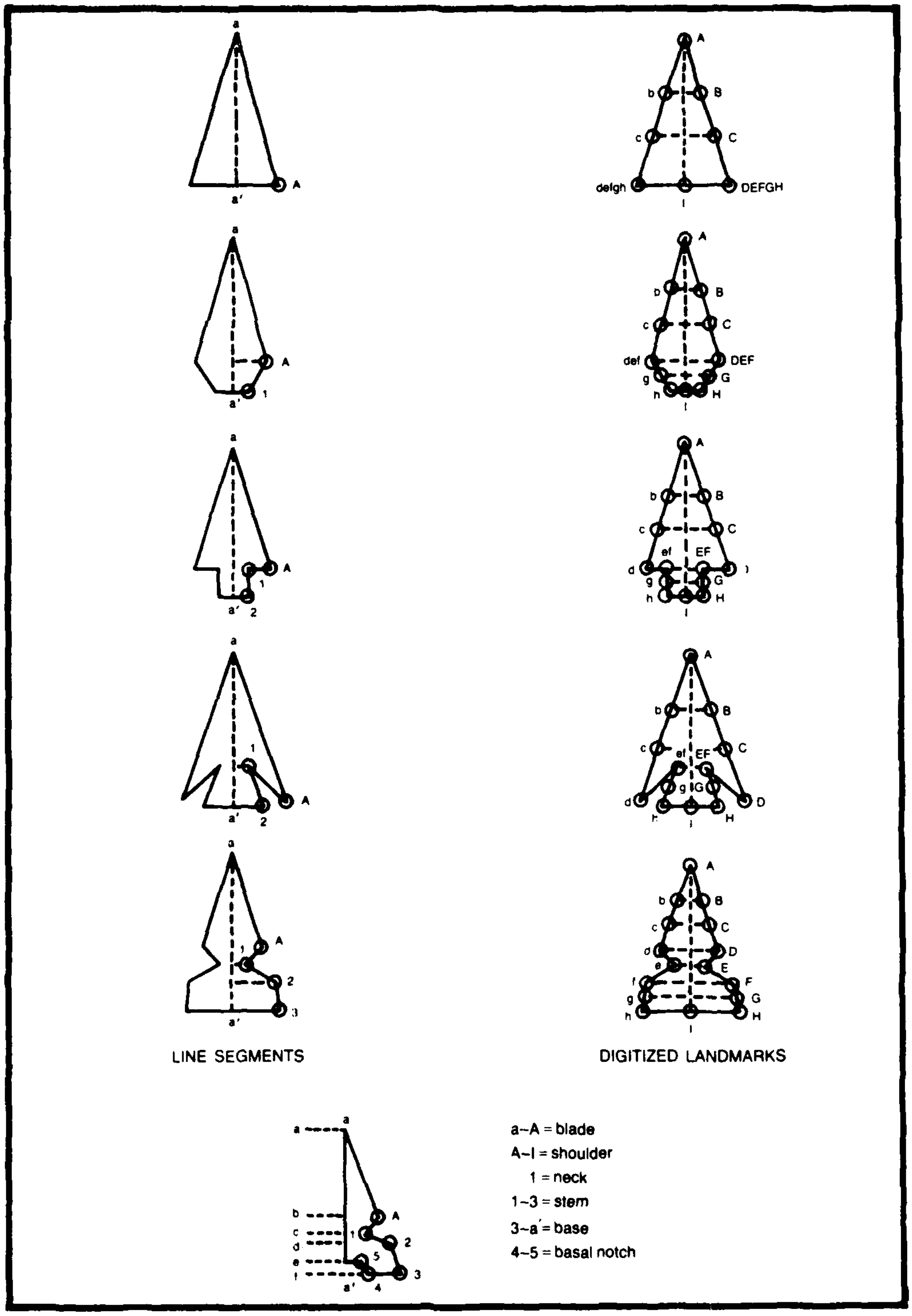


Figure 3-3. Definition of projectile point outline.

We might subdivide any or all of the types in terms of their basal edge shape, serration, or flaking pattern. We can also assess the chronological significance of concave bases, serrated margins, or regular collateral flaking pattern independent of associated morphological type. Further, we can use this information to establish variants in the basic historical types.

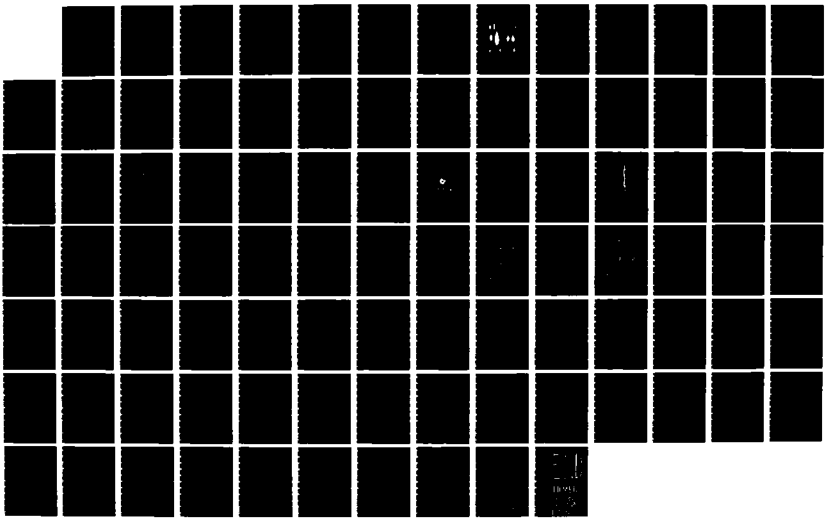
Table 3-21. Morphological classes of projectile points: descriptive name, classification code, and line segment definition.

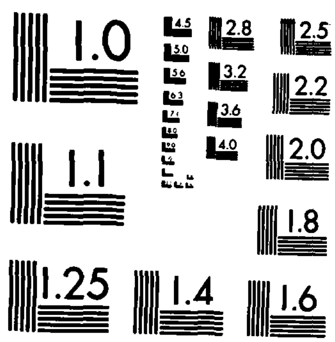
Type	Description	Classification	Definition
1	Large Triangular	N 1 N 1	$\overline{\text{a A}}$
2	Small Triangular	N 1 N 2	$\overline{\text{a A}}$
3	Large Side-notched	1 N N 1	$\overline{\text{aA123}}$, $\overline{\text{aA1234}}$, $\overline{\text{aA12345}}$
4	Small Side-notched	1 N N 2	$\overline{\text{aA123}}$, $\overline{\text{aA1234}}$, $\overline{\text{aA12345}}$
5	Lanceolate	N 2 N N	$\overline{\text{a A}}$
6	Shouldered Lanceolate	2 2 N N	$\overline{\text{a A}}$, $\overline{\text{aA1}}$, $\overline{\text{aA12}}$
7	Large, Shouldered Triangular, contracting stem	2 1 2 1	$\overline{\text{a A}}$, $\overline{\text{aA1}}$
8	Small, Shouldered Triangular, contracting stem	2 1 2 2	$\overline{\text{a A}}$, $\overline{\text{aA1}}$
9	Large, Shouldered Triangular, non-contracting stem	2 1 (13) 1	$\overline{\text{aA12}}$, $\overline{\text{aA123}}$
10	Small, Shouldered Triangular, non-contracting stem	2 1 (13) 2	$\overline{\text{aA12}}$, $\overline{\text{aA123}}$
11	Large, Squared Triangular, contracting stem	3 1 2 1	$\overline{\text{aA1}}$
12	Small, Squared Triangular, contracting stem	3 1 2 2	$\overline{\text{aA1}}$
13	Large, Squared Triangular, non-contracting stem	3 1 (13) 2	$\overline{\text{aA12}}$, $\overline{\text{aA123}}$
14	Small, Squared Triangular, non-contracting stem	3 1 (13) 1	$\overline{\text{aA12}}$,$\overline{\text{aA123}}$
15	Large, Barbed Triangular, contracting stem	4 1 2 1	$\overline{\text{aA1}}$
16	Small, Barbed Triangular, contracting stem	4 1 2 2	$\overline{\text{aA1}}$
17	Large, Barbed Triangular, non-contracting stem	4 1 (13) 1	$\overline{\text{aA12}}$, $\overline{\text{aA123}}$
18	Small, Barbed Triangular, non-contracting stem	4 1 (13) 2	$\overline{\text{aA12}}$ $\overline{\text{aA123}}$

AD-A163 134 ARCHAEOLOGICAL INVESTIGATIONS AT SITE 45-DO-211 CHIEF JOSEPH DAM PROJECT WASHINGTON(U) WASHINGTON UNIV SEATTLE OFFICE OF PUBLIC ARCHAEOLOGY E D LOHSE ET AL. 1984 DACW67-78-C-0106

2/2

UNCLASSIFIED F/G 5/6 NL





MICROCOPY RESOLUTION TEST CHART
NATIONAL BUREAU OF STANDARDS-1963-A

We have defined historical types on the basis of line and angle measurements in order to have a consistent classification method which utilizes published illustrations of projectile points. Other measurements such as weight and thickness were taken on projectile points in our collection, but problems of cost and efficiency precluded handling of specimens from other study areas. These measurements can be included in analyses of our points, and, hence, for definition of types and type variants that will correlate with acknowledged types, but they are not part of the initial typological exercise. Justification for this decision is found in prior research emphasizing the outline of projectile points as the basis of classification (Ahler 1979; Benfer 1967; Gunn and Prewitt 1975; Holmer 1978).

Our desire for a statistically derived classification prompted selection of a multivariate statistical method termed discriminant analysis (Nie et al. 1975). In this analysis, individual specimens are sorted into selected groups on the basis of mathematical equations derived from analysis of cases with known memberships. First, we assembled representative specimens for each acknowledged historical type, and tested group autonomy through analysis of specified discriminating variables. Then, we used derived equations called discriminant functions to assign specimens in our collection to the statistically defined projectile point types. All cases are given a probability of group membership, calculated as the distance a given case score is away from a group score. Discriminating variables--those providing the most separation between groups--are ranked and serve as type definitions. The outcome is a statistically defensible projectile point typology based on traditional, intuitively derived classifications. The resulting classification is consistent, and produces mathematically defined ranges of variability. It enables the researcher to quickly categorize a large collection, and it offers a sound, rational basis for definition of new types as well as an explicit definition of accepted types. We can thereby correlate the Rufus Woods Lake projectile point sequence with other chronologies in both a quantitative and qualitative manner. For a detailed discussion of procedures and assumptions involved in discriminant analysis see Johnson (1978) and Klecka (1980).

We assembled a type collection for the Columbia Plateau of over 1,200 specimens that constituted originally defined type examples, labelled specimens of recognized types, or type variants that were reasonably well-dated. By critically reviewing the archaeological literature, we identified 23 historical types which we arranged in six formal type series (Figure 3-4). We consistently applied distinctions based on the original type definitions, modified, where appropriate, by subsequent research. We routinely defined type variants, usually suggested by prior researchers, which segregate specimens according to diagnostic patterns in morphology. Historical types identified here represent a synthesis of projectile point types and cultural reconstructions postulated by researchers in different areas of the Columbia Plateau, and were not taken from any single typology or chronological sequence (e.g., Butler 1961, 1962; Leonhardy and Rice 1970; Nelson 1969). Names are usually those applied by the first researcher to define a specific type. We developed variant labels by using the accepted type name followed by a letter

HISTORICAL TYPE CLASSIFICATION

DIVISION	LANCEOLATE		TRIANGULAR			
SERIES	SIMPLE	SHOULDERED	SIDE-NOTCHED	CORNER-REMOVED	CORNER-NOTCHED	BASAL-NOTCHED
TYPE	11 LARGE LANCEOLATE	12 LIND COULEE	41 COLD SPRINGS	51 NESPELEM BAR	61 COLUMBIA A Corner-notched	71 QUILOMENE A Basal-notched
	15 WINDUST C Contracting base	13 WINDUST A	42 PLATEAU Side-notched	52 RABBIT ISLAND A	62 QUILOMENE Corner-notched	72 QUILOMENE B Basal-notched
	21 CASCADE A	14 WINDUST B		53 RABBIT ISLAND B	63 COLUMBIA B Corner-notched	73 COLUMBIA STEM A
	22 CASCADE B	31 MAHKIN SHOULDERED			64 WALLULA Rectangular stemmed	74 COLUMBIA STEM B
	23 CASCADE C					75 COLUMBIA STEM C

Types are numbered consecutively within formal series a two-digit code indicates the approximate temporal sequence of defined series and types

Type names are those most commonly applied Mahkin Shouldered and Nespelem Bar are types defined for the Rufus Woods Lake project area

Figure 3-4. Defined historical projectile point types.

denoting diagnostic variation. For a complete discussion of procedures followed see Lohse (1984g).

Table 3-22 lists projectile points from 45-DO-211. Table 3-23 lists classified projectile point fragments. The top row on the table provides a key to the columns. Type refers to the defined historical types. Classification records the attributes coded for each of the 11 dimensions; the first four underlined digits correspond to the morphological types. Zone lists the analytic zone containing the artifact. Feature notes any association between the artifact and a cultural feature, and association indicates the nature of this association.

Table 3-22. Classified projectile points, 45-DO-211.

Type	Classification	Zone	Feature	Association
Nespelem Bar	21212221NN3	5	14	Below housepit 2
Rabbit Island B	21222121NN1	4:HP2 Floor	57	Housepit 2 fill
Rabbit Island B	21222122NN1	2	—	Above Housepit 2
Nespelem Bar	21222221NN1	1	—	—
Nespelem Bar	21229122NN1	4:HP2 Floor	12	Housepit 2 fill
Nespelem Bar	22212221121	4:HP2 Floor	13	Housepit 2 floor
Nespelem Bar	22N12221121	3	—	—
Columbia A Corner-notched	22322121121	5	53	Below Housepit 2
Rabbit Island A	31212122NN2	2	—	—
Nespelem Bar	N2N12221111	4	—	—
Nespelem Bar	N2N12221111	4	19	Housepit 3 fill
Nespelem Bar	N2N12221121	3:HP2 Fill	57	Housepit 2 fill
Not Assigned	N1N12211NN1	3:HP2 Fill	57	Housepit 2 fill
Not Assigned	N1N12221NN1	1	—	Above Housepit 2
Not Assigned	N1N22221NN1	3	—	—
Not Assigned	N1N22221NN1	1	—	Above Housepit 2

Table 3-23. Classified projectile point fragments, 45-DO-211.

Type	Classification	Zone	Feature	Association
Incomplete				
—	21222121NN1	4:HP2 Floor	57	Housepit 2 fill
—	31222121NN1	2	—	Above Housepit 2
—	N2212221111	Slump	—	Housepit 2 fill
—	N2N21221111	1	—	Above Housepit 2
Bases				
—	N1N22221NN1	4:HP2 Floor	13	Housepit 2 floor
—	N2221221321	4	—	—
Stems				
—	21222929NN9	2	—	—
—	99111929NN1	2	—	Above Housepit 3
—	99212929NN9	5	—	—
—	99222929NN9	3	—	Above Housepit 2
—	99222929NN9	3:HP2 Fill	57	Housepit 2 fill
—	99222929NN9	2	—	—

THE 45-DO-211 PROJECTILE POINT ASSEMBLAGE

All sixteen classified projectile points are triangular forms, which vary in size and technical execution. The majority are sloping and straight-shouldered triangular points with rounded to sharply contracting stems. We coded 12 projectile point fragments and unfinished or incomplete forms within the morphological classification but could not assign them to a historical type. Fragments are primarily contracting stems and bases very like those characterizing the more complete projectile point forms. Unfinished or incomplete specimens are triangular but lack discernible haft elements. The classified projectile points and fragments are listed below in an outline form. Specimens are illustrated in Plate 3-5. Digitized outlines are shown in Appendix B, Figure B-1.

Nespelem Bar (51) N=8

Provenience:	Material:	Measurement:
Zone 1	Opal	2.8/1.4/0.5 cm
Zone 2	Opal	4.4/2.1/0.9 cm
Zone 3	Argillite	4.1/1.9/0.8 cm
Zone 4	Argillite	8.1/2.5/0.9 cm
Zone 5	Opal	3.4/1.7/0.7 cm
Zone 3:HP2 Fill	Argillite	3.6/1.6/0.8 cm
Zone 4:HP2 l r	Basalt	3.6/1.8/0.6 cm
Zone 4:HP2 Floor	Opal	2.8/1.3/0.4 cm

All of these specimens are weakly shouldered with broad, rounded, contracting stems. They vary widely in size, symmetry, and technique of manufacture. Specimens are typically made on thick primary flakes, several still retaining remnants of the striking platform, bulb of percussion, and cortex. Initial reduction entailed percussion flaking, followed by pressure flaking which varied in extent from sharpening of the lateral edges to complete reduction of the dorsal and ventral surfaces. One specimen (M#374) exhibits fine, even lateral serrations extending from the shoulder to the tip.

Comparable specimens are illustrated by Chance and Chance (1982), Collier et al. (1942), Greengo (1982), Nelson (1969), Rice (1969, 1972), Swanson (1962).

Rabbit Island A (52) N=1

Provenience:	Material:	Measurement:
Zone 2	Chalcedony	3.2/1.7/0.5 cm

This specimen, was made on a lightly banded, broad, chalcedony flake, and retains the bulb of percussion and original curvature of the flake. Flake scars are long and narrow, carrying well into the midline of the point. The lateral margins are delicately serrated, and the base has been thinned and rounded.

Comparable specimens are illustrated by Collier et al. (1942), Greengo (1982), Nelson (1969), Rice (1969, 1972); Swanson (1962).

Rabbit Island C (53) *N=2*

Provenience:	Material:	Measurement:
Zone 2	Jasper	2.3/ - /0.5 cm
Zone 3	Jasper	2.1/1.1/0.3 cm

Both points may have been broken during manufacture and aborted without further modification. However, both have well-defined shoulders and haft elements. M#200 has large serrations along one intact lateral margin. Both specimens were pressure flaked.

Comparable specimens are illustrated by Greengo (1982), Nelson (1969), Swanson (1962).

Columbia Corner-notched A (61) N=1

Provenience:	Material:	Measurement:
Zone 5	Opal	1.9/1.5/0.6 cm

This specimen appears to have been broken and reworked, judging from the stunted blade exhibiting large flake scars running from the distal margins and tip down to the blade-haft juncture. The stem is intact, and is broad and straight: this stem configuration places this specimen in TYPE 61.

Comparable specimens are illustrated by Chance and Chance (1982), Greengo (1982), Leonhardy (1970), Nelson (1969).

KEY

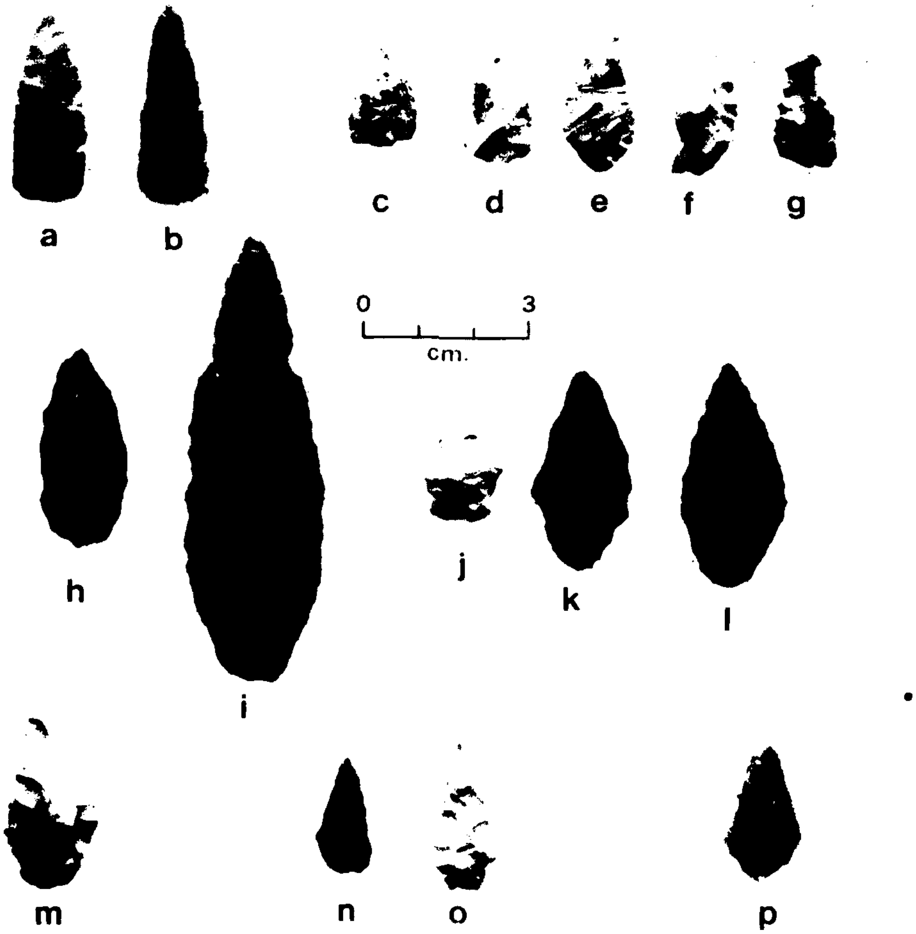
Master Number:
Morphological Type:
Tool:
Provenience/Level:
Zone:
Material:

a.	b.	c.	d.	e.	g.	f.
347	354	3	170	406	200	129
Type 1	Type 1	Type 2	Type 2	Type 8	Type 8	Type 8
Unnamed Triangular	Unnamed Triangular	Unnamed Triangular	Unnamed Triangular	Unassigned	Rabbit Island B	Nespelem Bar
54N26W/120	56N23W/30	Testing	2N11E/110	55N26W/130	55N28W/30	8N1E/50
3:HP2 Fill	2	-	3	4	2	2
Jasper	Petrified wood	Cryptocrystalline	Jasper	Jasper	Opal	Jasper

h.	i.	j.	k.	l.
207	124	441	429	147
Type 5	Type 5	Type 6	Type 6	Type 6
Nespelem Bar	Nespelem Bar	Columbia Corner-notched	Nespelem Bar	Nespelem Bar
55N27W/FE57/90	10N11E/FE19/110	57N26W/FE53/155	57N25W/FE13/150	2N10E/80
3:HP2 Fill	3	5	4:HP2 Floor	3
Argillite	Argillite	Opal	Fine-grained basalt	Basalt

m.	n.	o.	p.
317	229	374	394
Type 7	Type 8	Type 8	Type 11
Nespelem Bar	Rabbit Island B	Nespelem Bar	Rabbit Island A
53N25W/FE14/150	58N24W/FE57/125	56N24W/FE12/140	55N26W/30
5	4:HP2 Floor	4:HP2 Floor	2
Opal	Jasper	Opal	Chalcedony

Plate 3-5. Projectile points, 45-DO-211.


a
b
c
d
e
f
g
0
3
cm.
h
i
j
k
l
m
n
o
p

Unnamed Triangular Points (81) N=4

Provenience:	Material:	Measurement:
Zone 1	Petrified Wood	3.9/1.4/0.5 cm
Zone 1	Jasper	2.0/1.3/0.6 cm
Zone 3	Opal	2.5/1.3/0.3 cm
Zone 3:HP2 Fill	Jasper	3.6/1.4/0.5 cm

All four specimens are simple triangular forms, and may represent blanks or finished projectile points. Margins show grinding or battering evidence of wear or of further intended reduction. All were pressure flaked.

Comparable specimens are illustrated by Chance and Chance (1982), Nelson (1969), Swanson (1962).

Unfinished or Incomplete Forms N=7

Provenience:	Material:	Measurement:
Zone 1	Jasper (fragment)	2.5/1.6/0.6 cm
Zone 2	Opal (fragment)	2.3/1.2/0.5 cm
Zone 4:HP2 Floor	Opal (fragment)	2.4/1.1/0.6 cm
Zone 4:HP2 Floor	Jasper	2.2/1.1/0.2 cm
Zone 4:HP2 Floor	Jasper	2.6/1.4/0.4 cm

These specimens were not totally reduced, but appear to have been roughed out into a projectile point form and abandoned. The reductive process appears to have been similar for all specimens: a flake of about the right size and shape was crudely made into the proper form by pressure flaking; the ventral and dorsal surfaces were reduced further; the margins were reduced to a fine edge and/or serrated; the base was thinned or otherwise modified. All specimens show less primary concern with the base or stem than with the blade. These forms most closely resemble Rabbit Island Stemmed points.

Comparable specimens are illustrated by Chance and Chance (1982): finished and unfinished forms from the Takumakst Period; Nelson (1969): fragments and miscellaneous examples from the Frenchman Springs Phase.

Detached Stems N=6

Provenience:	Material:	Measurement:
Zone 5	Opal	1.1/1.5/0.7 cm
Zone 3	Opal	1.0/1.2/0.4 cm
Zone 3:HP2 Fill	Jasper	0.7/1.1/0.4 cm
Zone 2	Opal	0.9/1.4/0.5 cm
Zone 2	Jasper	1.3/1.4/0.5 cm
Zone 2	Argillite	1.1/1.2/0.5 cm

All specimens have contracting stems, four have rounded bases, and two have squared bases. Only one retains a portion of its shoulder. The others were snapped just below the shoulder-stem junction, or at the neck. Four of the specimens represent projectile points with well developed shoulders, as indicated by the length and proportions of stems. The other two are more squat and rounded. Although most probably are examples of shouldered projectile points, they could represent either shouldered triangular forms or lanceolates.

Comparable specimens are illustrated by Chance and Chance (1982): stemmed forms common throughout Ksunku and Takumakst cultural periods (ca. 4500-1500 B.P.); Nelson (1969): stemmed forms indicative of Frenchman Springs and Quilomene Bar phases (ca. 4000-2000 B.P.); Swanson (1962): stemmed forms characteristic of the Frenchman Springs cultural period (Phases I, II, III) (ca. 3500-1000 B.P.).

Broken Bases N=2

Provenience:	Material:	Measurement:
Zone 4	Jasper	1.6/1.7/.5 cm
Zone 4:HP2 Floor	Opal	1.6/1.3/.5 cm

The jasper specimen has straight margins and a squared base. The basal margin has been thinned, and lateral margins have been ground or worn. The opal specimen has excurvate margins and a rounded base. The basal margin has been roughly thinned. The lateral margins show no signs of grinding or wear, but one side does show a short series of serrations. The jasper specimen may represent a classic, square-based, basally thinned, edge ground, lanceolate form. The opal specimen appears to represent a teardrop shaped, serrated, lanceolate form.

The jasper specimen is of a form considered characteristic of the Vantage Phase and/or Cold Springs Phase (Nelson 1969) or the Shonitkwu-Takumakst-Ksunku cultural periods (Chance and Chance 1982), or about 8000-4000 B.P. The opal specimen represents a form that appears throughout the Vantage, Cold Springs and Frenchman Springs phases (Nelson 1969).

SUMMARY

Projectile point types and projectile point fragments from 45-DO-211 indicate occupation in the Hudnut Phase (ca. 4000-2000 B.P.) defined for the Rufus Woods Lake project area and correlated with the Frenchman Springs Phase defined for the Middle Columbia River (Nelson 1969; Swanson 1962). Eight of the 16 classified projectile points are Nespelem Bar, a type defined within the Rufus Woods Lake project area. Although encompassing a wide range of related forms, this type is distinct from the Rabbit Island Stemmed A and B variants, and is found in radiocarbon dated associations from about 5100 B.P. and 2000 B.P. (Lohse 1984g). A Rabbit Island A and two Rabbit Island B point types are also present, firmly placing occupation in the Hudnut Phase. The single Columbia Corner-notched A point is less diagnostic in the Rufus Woods Lake project area; it is found in occupations radiocarbon dated from about 5000-500 B.P. Unfinished or incomplete projectile point forms and detached stems and bases all indicate the same time frame as the projectile point types (Hudnut Phase, ca. 4000-2000 B.P.). The only possible exception is the square end, lanceolate base from Zone 4 (Unit 0N6E, 200 cm b.u.d.), which was found just above the cobble and sand stratum that underlies cultural occupations at the site. This base and the radiocarbon date of 5497±142 B.P. may indicate a sparse cultural occupation during the latter part of the Kartar Phase (ca. 7000-4000 B.P.). However, the overall distribution of projectile point types and associated radiocarbon dates firmly place occupations in Zones 4, 3, 2, in the Hudnut Phase. Activities in Zone 1 may date to the Hudnut Phase as well, but our only diagnostic artifacts are historic American and Chinese artifacts spanning the last part of the nineteenth century up to the present (Thomas et al. 1984).

Artifacts other than projectile points from this site do not help us assess the temporal pattern observed in the distribution of historic projectile point types. Bifaces and biface fragments do not supply any cultural or temporal divisions. Stone and shell beads found here are comparable to forms dated in contexts spanning the seven thousand years of occupation in the Rufus Woods Lake project area. A single dentalium shell bead is noteworthy, not for its definition of any bounded time period, but because it dates sometime between about 3500-2700 B.P. (3636±100 B.P., 3505±74 B.P., below Housepits 1 and 2, Zone 3; 2712±86, Housepit 2 floor), documenting an earlier use of these ornaments than commonly ascribed (Collier et al. 1942; Nelson 1969).

4. FAUNAL ANALYSIS

Zoological remains from archaeological sites provide a unique source of data on the ecology and historic biogeography of animal species living in the site area, and on utilization of faunal resources by human occupants. This chapter describes the faunal assemblage recovered from 45-DO-211, and summarizes the implications of the assemblage for understanding the archaeology of the site.

FAUNAL ASSEMBLAGE

The faunal assemblage from 45-DO-211 consists of 21,148 bone fragments weighing 4,091 g. Of these fragments, 1,653 (7.8%) were identified. The small proportion of identifiable fragments attests to the highly fragmented nature of the sample. Of the identified specimens 534 (32%) are mammalian, 64 (4%) are reptilian, 16 (1%) are amphibian, and 1,039 (63%) are fish. The distribution of faunal materials among zones is shown in Table 2-2. Taxonomic composition and distribution of the vertebrate remains are shown in Table 4-1. Also recovered were 9,793 shell fragments weighing 19,930 g. The shell from this site has not been analyzed. Shell analyzed in the testing phase of the project showed that shell in project area sites is predominantly *Margaritifera falcata* with a minor component of *Gonidea angulata* (Lyman 1978).

The following summarizes the taxa identified. Where necessary, criteria used to identify the specimens are included, as well as remarks concerning past and present distributions of the taxa and the possible cultural significance of bones and taxa. A summary of elements representing each taxon is provided in Appendix C.

SPECIES LIST

MAMMALS (NISP=534)

Sorex sp. (shrews) -- 1 element.

At least three species of shrew (*S. vagrans*, *S. cinereus*, and *S. merriami*) are present in the project area. Four other species (*S. palustris*, *S. bendirii*, *S. trowbridgii* and *Microsorex hoyi*) occur in areas to the east and/or west of the project area today and may have been present in the project area in the past (Hall 1981). The single recovered specimen could not be identified to species and probably is present in the assemblage as a result of natural processes.

Table 4-1. Taxonomic composition and distribution of vertebrate remains, 45-DO-211.

Taxa	Zone 1		Zone 2		Zone 3		Zone 4		Zone 5		3:HP2 Fill		4:HP2 Floor		Site Total	
	NISP	MNI	NISP	MNI	NISP	MNI	NISP	MNI	NISP	MNI	NISP	MNI	NISP	MNI	NISP[1]	MNI[2]
MAMMALIA (NISP=543)																
Soricidae																
Sorex sp.	-	-	-	-	-	-	-	-	1	1	-	-	-	-	1	1
Leporidae	1	-	-	-	-	-	-	-	-	-	-	-	-	-	1	-
Lepus cf. *townsendii*	-	-	-	-	1	1	1	1	-	-	-	-	-	-	2	1
Sylvilagus sp.	-	-	-	-	-	-	-	-	2	1	-	-	-	-	2	1
Sciuridae																
Marmota flaviventris	-	-	1	1	8	2	7	1	5	1	3	2	1	1	25	5
Spermophilus sp.	-	-	4	3	4	2	1	1	3	1	-	-	1	1	13	4
Geomyidae																
Thomomys talpoides	5	2	47	11	68	9	90	16	58	11	4	1	6	4	278	49
Heteromyidae																
Perognathus parvus	1	1	14	6	15	4	9	2	6	2	5	2	1	1	51	14
Cricetidae	3	-	5	-	5	-	1	-	2	-	-	-	2	-	18	-
Peromyscus maniculatus	-	-	1	1	-	-	2	1	-	-	-	-	-	-	3	2
Microtus sp.	-	-	7	3	1	1	-	-	1	1	1	1	-	-	10	5
Lagurus curtatus	4	3	16	8	9	5	6	6	4	1	-	-	-	-	39	21
Canidae																
Canis sp.	-	-	1	1	-	-	-	-	1	1	-	-	-	-	2	1
Canis cf. *latrans*	-	-	-	-	-	-	1	1	-	-	-	-	-	-	1	1
Mustelidae																
Mustela frenata	-	-	-	-	-	-	-	-	3	1	-	-	-	-	3	1
Taxidea taxus	-	-	-	-	-	-	-	-	-	-	1	1	-	-	1	1
Cervidae	-	-	1	-	-	-	-	-	1	-	-	-	-	-	2	-
Odocoileus sp.	-	-	6	1	5	1	2	1	2	1	17	1	10	1	42	1
Deer-Sized	-	-	2	-	4	-	10	-	5	-	1	-	16	-	38	-
Bovidae																
Ovis canadensis	-	-	1	1	-	-	-	-	-	-	-	-	-	-	1	1
REPTILIA (NISP=64)																
Chelydridae																
Chrysemys picta	-	-	4	-	10	-	3	-	6	-	3	-	1	-	27	-
Colubridae	-	-	-	-	7	-	24	-	5	-	-	-	-	-	36	-
Viperidae																
Crotalus viridis	-	-	1	1	-	-	-	-	-	-	-	-	-	-	1	1
AMPHIBIA (NISP=16)																
Ranidae/Bufonidae	-	-	-	-	1	1	1	1	13	1	-	-	1	1	16	1
PISCES (NISP=1,039)																
Salmonidae	1	-	32	-	125	-	851	-	10	-	1	-	-	-	1,020	-
Oncorhynchus tshawytscha	1	-	1	-	-	-	7	-	1	-	-	-	-	-	10	-
Cyprinidae	-	-	1	-	-	-	1	-	-	-	-	-	-	-	2	-
Catostomidae	-	-	-	-	-	-	7	-	-	-	-	-	-	-	7	-
Total	16		145		263		1,024		129		36		39		1,652	

[1] Number of Identified Specimens
[2] Minimum Number of Individuals

Leporidae (rabbits and hares) - 1 element.

Lepus cf. townsendii -- 2 elements.

Two species of Lepus inhabit the project area at present: L. townsendii (white-tailed hare) and L. californicus (black-tailed hare). A third species, L. americanus (snowshoe hare), inhabits regions adjacent to the project area. These elements could not be assigned to species on the basis of morphological features. L. californicus is thought to have immigrated from the Great Basin during the early part of the twentieth centry (Couch 1927; Dalquest 1948). L. americanus is largely nocturnal and secretive and inhabits wooded areas. Consequently, the specimens have been assigned to L. cf. townsendii.

Ethnographically hares were hunted actively both for fur and meat (Ray 1932:87; Post, in Spier 1938:24). While there is no direct evidence that these specimens were deposited as a result of human activity, we suspect the bones are present because of cultural processes.

Sylvilagus sp. (cottontails) -- 2 elements.

Two native and one introduced species representing this genus may be present in the site area (Dalquest 1941). The identified specimens probably represent S. nuttallii, the larger of the two native species. S. idahoensis is smaller and at present is restricted largely to the central Columbia Plateau. S. floridanus was introduced near Pullman in the 1920s and at several localities in Western Washington in the early 1900s (Dalquest 1941). This species has since increased in abundance and now occupies a fairly large portion of the state (Dalquest 1948). S. nuttallii and S. floridanus are subequal in size (Hall 1981).

S. nuttallii is an abundant resident of rocky sagebrush zones in the project area. Like hares, cottontails were exploited by ethnographic peoples for fur and meat (Post, in Spier 1938; Ray 1932). We suspect that these specimens were deposited as a result of human activity.

Marmota flaviventris (yellow-bellied marmot) -- 25 elements.

All marmot remains have been assigned to the species M. flaviventris on the basis of present distribution; this species is the only marmot now living in the project area and is a common resident of talus slopes. M. monax has been recorded in extreme northeastern Washington and M. calagata occurs in the Cascades to the west of the project area (Ingles 1965; Dalquest 1948). The three species are indistinguishable on the basis of osteological morphology, and the size ranges of the three overlap extensively. Potential changes in distribution or cultural transport of

animals preclude dismissing the possible occurrence of one or both of the more montane species in this assemblage.

Marmots were used as small game by ethnographic inhabitants of eastern Washington (Ra, 1932; Post, in Spier 1938). Their presence in this faunal assemblage may indicate prehistoric use.

Spermophilus sp. (ground squirrels) -- 13 elements.

Three species of ground squirrels are currently found in eastern Washington: *Spermophilus columbianus*, *S. washingtoni*, and *S. townsendii*. *S. columbianus* is larger than the other two and prefers more mesic habitats. *S. washingtoni* and *S. townsendii* are smaller and prefer sagebrush and grass zones to the south and east of the project area (Dalquest 1948:268; Ingles 1965:169). These elements could not assigned to species.

Ground squirrels have been reported as a food resource in the ethnographic literature (Ray 1932:82).

Thomomys talpoides (northern pocket gopher) -- 279 elements.

Thomomys talpoides is the only geomyid rodent in the project area. Because pocket gophers are extremely fossorial, their presence in this assemblage probably is the result of natural processes.

Perognathus parvus (Great Basin pocket mouse) -- 51 elements.

Perognathus parvus is the only heteromyid rodent recorded in the project area. A common burrower in sagebrush areas, *P. parvus* probably is responsible for some sediment disturbance in the site.

Perognathus parvus probably is present in 45-DO-211 as a result of natural processes. No ethnographic or archaeological data suggests otherwise.

Cricetidae (New World rats and mice) -- 18 elements.

Peromyscus maniculatus (deer mouse) -- 3 elements.

Deer mice are ubiquitous in the state of Washington (Dalquest 1948). They are at least in part fossorial, and their bones probably occur in this assemblage as a result of natural processes.

Microtus sp. (meadow mice) -- 10 elements.

Three species of *Microtus* occur in the site area: *M. montanus*, *M. pennsylvanicus* and *M. longicaudus*. All three species tend to inhabit marshy areas or areas near streams. *M. montanus* can also be found in more

xeric areas (Maser and Storm 1970). There is no evidence to suggest that this genus is present because of cultural processes; microtines probably died naturally in the site.

Lagurus curtatus (sagebrush vole) -- 39 elements.

Sagebrush voles inhabit dry sagebrush areas with little grass (Maser and Storm 1970:142). Only cranial material of this species is distinguishable from *Microtus* sp. The occlusal surface of M^3 (Maser and Storm 1970) and the location of the mandibular foramen (Grayson 1984) are distinctive.

Canis sp. (wolf, coyote, or dog) -- 2 elements.

Canis cf. *latrans* -- 1 element.

Both *Canis latrans* (coyote) and *C. familiaris* (domestic dog) are common in the project area today. *C. latrans* is an indigenous species, and *C. familiaris* has great antiquity in the Northwest (Lawrence 1968). *C. lupus* (wolf) is known to have been a resident in the past but has been locally extinct since about 1920 (Ingles 1965). It was not possible to determine the species represented by two of these elements. The third element, given its overall morphology and robustness, probably is from a coyote. It is unclear whether these three elements were deposited as a result of cultural or natural processes.

Mustela frenata (long-tailed weasel) -- 3 elements.

The long-tailed weasel (*M. frenata*) is ubiquitous in Washington, while the ermine (*M. erminea*) seems to be restricted more to forested areas (Dalquest 1948). These two species do overlap in size to some degree, particularly females of *M. frenata* and males of *M. erminea* (Kurten and Anderson 1980). On the basis of the size of the recovered specimens and present distributions of these species, we have assigned the recovered specimens to *M. frenata*.

Pelts of weasels were used ethnographically as decorations on garments (Ray 1932:49). However, because both species of small mustelids actively seek various rodents as prey, often entering rodent burrows when hunting, we are unable to determine whether the mustelid remains in this site are the result of natural or cultural processes.

Taxidea taxus (badger) -- 1 element.

Taxidea taxus is a powerful burrower and is found throughout eastern Washington, although not in large numbers. Badgers were trapped regularly by the Sanpoil and Nespelem (Ray 1932:85). It is unclear whether this specimen was deposited as a result of natural or cultural processes.

Ovis canadensis (bighorn sheep) -- 1 element.

Ovis canadensis occurs in archaeological sites in eastern Washington with some regularity. The presence of this species is somewhat difficult to interpret, however, because references in the ethnographic literature are scarce and because the habitat preference of the species appears to have changed when competition with man and domestic stock became severe during historic times (Manville 1980). Bighorn are known ethnographically to have been exploited for meat and as a source of horn, which was used to make tools (Spinden 1908). This specimen may have been deposited as a result of human activities.

Cervidae (deer, elk) - 2 elements.

Odocoileus sp. (deer) -- 39 elements.

Two species of deer may be represented in this assemblage, *Odocoileus hemionus* and *O. virginianus*. None of the identified elements could be assigned to the species level. Deer are thought to have represented a major food resource to the prehistoric inhabitants of eastern Washington (Gustafson 1972), as they did for the ethnographic cultures (Post, in Spier 1938; Ray 1932). We suspect these elements were deposited as a result of cultural processes.

Deer-Sized (deer, antelope, sheep) -- 38 elements.

REPTILIA (NISP=64)

Chrysemys picta (painted turtle) -- 27 elements.

The turtle shell in this assemblage is too fragmentary to determine whether it is carapace or plastron. *C. picta* is the only turtle currently living in the project area. *Clemmys marmorata* (western pond turtle) has been reported in the eastern part of Washington in the ethnographic literature, but there is no way to ascertain if the taxonomic identification is accurate. *C. marmorata* now occurs only on the west side of the Cascades and in the southern part of the state (Stebbins 1966). On the basis of present distribution, all turtle remains have been assigned to *C. picta*. *C. picta* prefers the quiet or sluggish water of ponds, marshes, and streams with weed-grown muddy bottoms (Stebbins 1966). It could easily have inhabited the shoreline of the Columbia River in some areas and nearby ponds and streams.

The Sanpoil-Nespelem ate turtles (Ray 1932), but apparently only rarely. We suspect that the recovered elements are present as a result of cultural processes.

Colubridae (garter snakes and allies) -- 36 elements.

Crotalus viridis (rattlesnakes) - 1 element.

Four species of colubrids and one of vipers are found in the project area today (Stebbins 1966). Genus and species level identification were not possible for members of the former family. The two families were distinguished largely on the basis of overall size and robustness of the vertebrae. Rattlesnakes tend to have larger, more robust vertebra. The identifications should, however, be viewed as tentative. All snake bones probably are present in the assemblage as a result of natural processes.

AMPHIBIA (NISP=16)

Ranidae/Bufonidae (frogs, toads) -- 16 elements.

Inadequate comparative collections precluded more precise identification of these specimens. Given present distributions of frogs and toads in the project area (Stebbins 1966), the specimens may represent one or both of the two families. The recovered elements probably were deposited as a result of natural processes.

PISCES (NISP=1,039)

Salmonidae -- 1,030 elements.

These vertebrae could belong to any one of at least eight species of salmonid fish known in the project area. All fish vertebrae with parallel-sided, fenestrated centra were assigned to this family.

Oncorhynchus tshawytscha -- 10 elements.

The ten otoliths collected from 45-DO-211 all represent the chinook salmon (Casteel 1974). This species was important in the subsistence round of indigenous ethnographic peoples (Post, in Spier 1938; Ray 1932) and apparently was exploited by the Sanpoil-Nespelem in May and June (Ray 1932). Chinook could have been present in eastern Washington at any time between April and October although their availability in the project area would begin somewhat later (probably June) in most years (Schalk 1978).

Cyprinidae (minnows) - 2 elements.

Catostomidae (suckers) - 7 elements.

Inadequate comparative collections precluded more specific identifications of nonsalmonid fish vertebrae. Assignment to family was made on the basis of size; minnows tend to be smaller than suckers and thus have smaller vertebrae. At least seven species of cyprinid and four of catostomid occur in the project area. Some ethnographic groups did exploit these

fish. For instance, the southern Okanogan exploited suckers actively during spawning season (Post, in Spier 1938), although suckers are present in the Columbia and Okanogan rivers year-round and could be taken at any time. The recovered elements probably are present in the assemblage as a result of human activities.

DISCUSSION

Identified bone from 45-DO-211 provides information about butchering activities, animal resources exploited by site occupants, and seasonality of animal resource exploitation.

BUTCHERING

Evidence of butchering activities can take one of two forms: bone fragmentation patterns (Noe-Nygaard 1977) and butchering marks (Potts and Shipman 1981). Because fragmentation of bones may result from any number of natural processes (Bonnichsen and Will, in Gilbert 1980), only butchering marks are considered here. Two kinds of butchering marks were defined on the basis of their morphological characteristics.

Striae. Striae are cutmarks produced by drawing the edge of a sharp stone tool across a bone surface in a direction continuous with the long axis of the tool edge. They are elongate grooves that occur in groups of relatively parallel marks and are V-shaped in cross section (Potts and Shipman 1981). Striae may be expected to occur as a consequence of skinning, filleting meat from bones, dismembering the carcass at points of articulation, and stripping periosteum from bones in preparing elements for marrow extraction (Binford 1981).

Flaking. When green bones are struck a direct blow with a blunt instrument, the resultant fracture leaves crescentic, concholdal flake scars, which may be ringed with small, incompletely fractured impact chips (Binford 1981). Flake scars may be expected to occur when bone is fractured after the surrounding muscle tissue has been removed, for instance in the process of marrow extraction.

In addition to butchering marks, evidence of burning may indicate use of animal resources. Burning may occur if a bone is used as fuel or disposed of in a fire, or it can occur as a by-product of roasting (Wing and Brown 1979:109). Burned bones do not necessarily mean that the taxon was being exploited as a food resource, but they can be interpreted as evidence of some kind of human activity involving the taxon. Bones may be burned as a result of natural factors (Balme 1980), but if bones of a taxon are burned and also display butchering marks or are associated with artifacts then it may be argued that the bones are present as a result of human activity.

This butchering data affords a conservative indication of exploitation of vertebrate faunal resources at 45-DO-211. The frequency of butchering marks on, or burning of, various elements may indicate either those elements most commonly butchered or burned or those elements that most commonly preserve traces of human activity (Binford 1981). Further, an animal may be butchered, and few if any of its bones may be artificially altered in the process (Guilday et al. 1962). A final possible bias is that only identifiable bones were examined for presence of butchering marks and burning; unidentifiable butchered bone and/or burned bone was not recorded. Consequently, the absence of butchering marks and/or burning cannot be interpreted as indicating that a given taxon or portion of an individual was not utilized.

The distribution of butchering marks and burned elements observed in the faunal assemblage is shown in Table 4-2. Twelve elements, representing at least three taxa, exhibit butchering marks and/or burning. Two of these elements are categorized as artifacts and have been discussed in Chapter 3. Most of the remaining elements represent artiodactyls.

Table 4-2. Distribution of butchering marks, burned bone, and bone artifacts (identifiable elements only), 45-DO-211.

Zone	Taxon	Skeletal Element	Butchering Mark		Burned
			Flaking	Striae	
2	*Deer-Sized*	*innominate fragment*			1
3	Deer-Sized	astragalus fragment			1
	Salmonidae	vertebra			1
4	*Odocoileus* sp.	frontal fragment		1	
	Deer-Sized	femur diaphysis	1		
	Deer-Sized	mandible fragment	1		
	Marmota	humerus fragment			1
	Marmota	tibia fragment			1
3:HP2 Fill	Deer-Sized	tibia diaphysis	1		
4:HP2 Floor	*Odocoileus* sp.	metatarsal diaphysis	1		
2	Cervidae	antler		artifact	
5	Cervidae	antler		artifact	

The small size of this sample precludes detailed interpretation, but the presence of butchering marks and the frequency of burned bone indicate that artiodactyls were a major food source at this site. Two burned elements suggest that marmots were exploited for food and/or furs. Only one nonmammalian taxon (Salmonidae) exhibits evidence of burning. The relatively high frequency of fish remains in this site further suggests salmonids were an important resource.

SEASONALITY

Two kinds of faunal data may be used as indicators of season of site occupation. The first is age at death of taxa with a known season of birth. We have estimated the age at death for three specimens of deer by reference to criteria described by Robinette et al. (1957) and Severinghaus (1949). Deer generally give birth in May or June (Ingles 1965). The second source of data indicating season of site occupation is the presence of seasonally active taxa. Elements from three seasonally active taxa were recovered from 45-DO-211. Marmots (Marmota flaviventris) enter estivation as early as June and go into hibernation in August or September (Ingles 1965; Dalquest 1948). They emerge in March. Painted turtles (Chrysemys picta) hibernate from late October until March or April (Stebbins 1966; Ernst and Barbour 1972). The chinook salmon (Oncorhynchus tshawytscha) is anadromous, and may be present in the project area from mid-June through October (Schalk 1978).

The use of either kind of data as an indicator of season of site *occupation assumes that the faunal remains were deposited during the inferred* season as the result of human activity and there has been no change in the seasonal behavior of the taxa involved. These assumptions have been discussed by Monks (1981). In brief, seasonality data indicate the season the animal died; the season of site occupation is an inference. The most reasonable means of controlling these assumptions is to use independent indicators of seasonality (e.g., different animal taxa, botanical data and/or sedimentological data). Different taxa probably were exploited and consumed during different seasons (Flannery 1968), and there is ethnographic data to this effect (Ray 1932; Post, in Spier 1938). Therefore, we can argue that when several taxa indicate the same season, the site probably was occupied during that season. The more taxa employed and the larger the sample size for each taxon, the more confidence can be placed in any final interpretation.

Although we may infer that a site was occupied during a given season, we cannot say that the site was not occupied during seasons not represented in the faunal assemblage. The absence of indicators of specific seasons may also indicate that the taxa exploited during those seasons do not contain seasonal information, that they were not introduced into the site, or that they were not preserved (Monks 1981:226).

The seasons of occupation indicated by each of four taxa at this site are presented by zone in Table 4-3. The data indicate the site may have been occupied at least during salmon spawning season when each zones was deposited.

Table 4-3. Seasonal indicators from the faunal assemblage, 45-DO-211.

Zone	Taxon Element	Age	Season of Death (Jan Feb Mar Apr May Jun Jul Aug Sept Oct Nov Dec)
1	*Oncorhynchus tshawytscha*		NISP=1
	Odocoileus sp. (mandible)	7 mo	
2	*Marmota flaviventris*		NISP=1
	Chrysemys picta		NISP=4
	Oncorhynchus tshawytscha		NISP=1
	Odocoileus sp.	5 yr 10 mo	
3	*Marmota flaviventris*		NISP=8
	Chrysemys picta		NISP=10
4	*Marmota flaviventris*		NISP=7
	Chrysemys picta		NISP=3
	Oncorhynchus tshawytscha		NISP=7
5	*Marmota flaviventris*		NISP=5
	Chrysemys picta		NISP=6
	Oncorhynchus tshawytscha		NISP=1
	Odocoileus sp.	3 yr 8 mo	
3:HP2 Fill	*Marmota flaviventris*		NISP=3
	Chrysemys picta		NISP=3
4:HP2 Floor	*Marmota flaviventris*		NISP=1
	Chrysemys picta		NISP=1

Sample sizes are largest for the three seasonally active taxa (mammals, turtles and salmon), but all three are active from late winter-early spring through early to late fall, an extremely broad range. Finer resolution is provided by the smaller sample of *Odocoileus* sp. specimens. The range of months indicated by deer teeth has been extended by several months because individual variation in wear patterns, from which age is assessed, increases with age and varies with location and forage type. The three specimens all indicate a December through April season, in contrast to the seasonally active taxa. Only late October and November are not firmly represented in any zone. The faunal assemblage then indicates that the site may have been occupied year round, but most available indicators suggest spring and summer site use.

SUMMARY

All taxa represented in the 45-DO-211 faunal assemblage, with the exception of *Ovis canadensis*, now live in or near the general site area. The assemblage is dominated by salmonid bones. The high relative abundance of fish remains suggests that exploitation of salmon was an important subsistence activity at 45-DO-211. Artiodactyls and sciurids appear to be the major mammalian taxa exploited by site occupants as indicated by relative abundances, ethnographic analogy, and the distribution of evidence of butchering. The other taxa are most likely present as a result of natural processes.

5. FEATURES

Analysis of finer temporal units and spatial distributions of artifacts and features within the zone is an important adjunct to the broad comparisons of zonal content made in the preceding chapters. The analytic zones necessarily span relatively long periods because finer temporal distinctions cannot be reliably correlated across the site. The zones combine the material products of numerous short-term activities, thus obscuring much small scale temporal and spatial variability in cultural activities. The detailed descriptions of individual features in this chapter supplement the zonal descriptions.

During excavations at 45-DO-211, 61 features were recorded in the field. Some of these represented natural strata and are not considered in feature analysis. Others were found to be redundant and combined, or inconsequential and disregarded. The cultural features which remained were classified according to a two-tiered paradigmatic classification (described in Campbell 1984d) which considers, on the one level, feature boundaries, provenience, shape and patterning; and, on the second level, the abundance of material contents. By combining the information of the paradigmatic classes with information on size and actual material counts, we have classified the features into functional types. These functional types are broadly defined as housepits, firepits, other pits, exterior occupation surfaces, and debris scatters. These, in turn, may be further subdivided: interior and exterior firepits and pits are differentiated, and bone, shell, and FMR concentrations are considered as separate functional types. Our feature typology provides the organization for this description of features at 45-DO-211 as well as for future comparisons of all cultural features recorded by the Project.

Table 5-1 lists the 35 cultural features at 45-DO-211 and reconciles them with the feature numbers assigned in the field (feature numbers are also referred to in the text parenthetically and in the tables). As can be seen in the table, six types of features were excavated at 45-DO-211. These features occur in four of the five zones. Housepits are confined to Zones 5 and 4, and date to between 3600 and 2700 B.P. The later zones contain only isolated artifact clusters, some poorly defined occupation surfaces, and shell concentrations. We describe these features zone by zone and then conclude with a more detailed analysis of the housepits and their contents. Basic feature information can be found in Table 5-1 (feature number, type, dimension, provenience and material contents), Table 5-2 (formed stone and bone objects), and Table 5-3 (identified faunal remains).

Table 5-1. Features by type, dimensions, depth, provenience, and contents by counts and weights, 45-DO-211.

Feature #	Feature type	Dimensions (cm)	Total Depth (cm)	Provenience	Debitage	Formed Objects		Bone		Shell		FMR		Estimated Volume (m^3)
						Lithic	Bone	#	g	#	g	#	g	
Zone 5														
	Housepit 1	5.5-6 m diameter	70	54-58N,26-28W, Levels 140-160										
5, 30, 58, 60	Floor				49	12	6	1,608	664	231	991	25	3,595	.842
42	Pit 1	45 diameter	34	54N26W, 140-174 cm b.u.d.*	2	-	-	53	24	1	1	-	-	.183
56	Pit 2	120 x 130	45	53N24-25W, 142-187 cm b.u.d.	8	2	2	274	152	20	-	4	850	.317
29	Pit 3	40 x 50	27	58N24W, 170-197 cm b.u.d.	-	-	-	28	3	18	134	3	1,210	.175
59	Stain	60 x 30	9	55N28W, 137-146 cm b.u.d.	-	-	-	46	5	-	-	5	290	.83
Zone 4														
	Housepit 2	5.5-6.5 m diameter	80	53-59N,22-28W, Levels 130-160										
12, 57	Fill				232	13	-	1,285	218	141	-	32	4,987	4.177
11, 13, 18, 49, 54, 61	Floor				145	17	1	4,032	789	340	494	243	42,877	1.802
20	Pit 4	90 diameter	54	58N23W, 141-195 cm b.u.d.	11	-	3	65	17	20	66	8	340	.242
No Number	Pit 5	40 diameter	55	see text										
	Housepit 3	unknown	60	10N10E, 100-150 cm b.u.d.										
19	Fill				111	15	-	446	80	2,255	4,814	74	14,870	1.30
32	Floor				9	3	-	674	108	228	515	16	1,290	.2
	Housepit 4	unknown	30-40	22N4E, Levels 140-160										
37, 38, 43	Floor 1				23	8	2	283	55	392	-	16	6,540	.133
28	Floor 2				23	-	-	861	176	22	-	43	7,214	.25
26	Occupation Surface	unknown	10-15	2N10E, Levels 160, 170	12	3	-	862	105	33	86	37	5,960	.171
33	Pit 6	50 diameter	16	2N10E, 156-172 cm b.u.d.	3	-	-	750	186	1	4	15	1,380	.108
8	Pit 7	35 radius	40	16N0E, 170-176 cm b.u.d.	-	-	-	156	18	-	-	-	-	.05
Zone 3														
1	Artifact Cluster	80 x 75		58N28W, Level 90	-	1	-	-	-	1	3	1	15	.10
3	Artifact Cluster	80 x 100		42N32W, Level 50	-	2	-	-	-	-	-	3	840	.06
46, 47	Shell Scatter	75 x 75		58N22W, 42-50 cm b.u.d.	1	1	-	2	-	67	186	9	2,240	.086
23	Occupation Surface	unknown	10-15	22N4E, Levels 120, 130	40	1	-	421	64	1	-	17	9,270	.40
Zone 2														
9	Occupation Surface	unknown	10-15	22N4E, Levels 90, 100	67	12	2	725	161	1	1	30	5,084	.40
6	Shell Layer A	unknown	20	12N14E, Levels 20-60	86	2	-	43	12	180	394	81	15,250	.70
45	Shell Layer B	unknown	20-25	32N8E, Levels 30-60	2	-	-	20	41	2,690	6,655	28	3,960	.233

* b.u.d. = below unit datum

Table 5-2. Formed stone and bone objects associated with features, 45-DO-211.

Feature	Lithic															Shell	Bone			
	Utilized flake	Unifacially retouched flake	Bifacially retouched flake	Biface	Projectile point	Projectile point base	Projectile point tip	Linear flake	Core	Tabular knife	Hammerstone	Chopper	Peripherally flaked cobble	Millingstone	Indeterminate	Bead	Needle	Wedge	Flaked long bone	Indeterminate
Zone 5																				
Housepit 1																				
Floor	3	–	–	–	–	–	–	–	–	3	–	1	2	–	3	–	–	–	5	1
Pit 2	2	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	1	–	1
Zone 4																				
Housepit 2																				
Fill	4	1	–	2	2	–	–	–	–	2	–	–	–	–	2	–	–	–	–	–
Floor	3	2	1	1	2	1	2	–	–	2	–	–	2	–	1	–	–	–	–	1
Pit 4	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	1	–	2	–
Housepit 3																				
Fill	5	1	–	–	1	–	–	1	2	2	–	–	–	–	3	–	–	–	–	–
Floor	–	1	–	–	–	–	–	–	–	2	–	–	–	–	–	–	–	–	–	–
Housepit 4																				
Floor 1	5	–	–	–	–	–	–	–	–	3	–	–	–	–	–	–	–	–	1	1
Occupation Surface	2	–	–	–	–	–	–	–	–	–	–	–	–	–	–	1	–	–	–	–
Zone 3																				
Artifact cluster	–	–	–	–	–	–	–	–	–	–	–	–	–	1	–	–	–	–	–	–
Artifact cluster	–	–	–	–	–	–	–	–	–	–	–	–	–	1	1	–	–	–	–	–
Shell scatter	–	–	–	–	–	–	–	–	–	–	–	–	1	–	–	–	–	–	–	–
Occupation surface	1	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
Zone 2																				
Occupation Surface	5	3	–	1	–	–	–	1	–	1	1	–	–	–	–	–	–	–	–	2
Shell layer A	–	–	–	–	–	–	–	–	–	1	1	–	–	–	–	–	–	–	–	–

Table 5-3. Identified faunal remains associated with features, 45-DO-211.

Feature	Deer	Deer-sized	Elk-sized	Salmon	Chinook salmon	Catostomus sp. (suckers)	Turtle	Snake	Frog	Marmot	Badger	Ground squirrel	Pocket gopher	Pocket mouse
Zone 5														
Housepit 1														
Floor	2	8	–	6	–	–	2	–	–	1	–	–	3	–
Pit 1	–	3	–	2	–	–	–	–	–	–	–	–	–	–
Pit 2	–	2	–	–	–	–	–	–	–	–	–	–	–	–
Pit 3	–	–	–	–	–	–	–	–	–	–	–	–	–	–
Stain	–	–	–	–	–	–	–	–	–	1	–	–	–	–
Zone 4														
Housepit 2														
Fill	6	1	–	–	–	–	1	–	1	–	1	–	5	1
Floor	5	15	1	–	–	–	–	–	–	–	–	–	2	1
Pit 4	–	1	–	–	–	–	–	–	–	–	–	–	1	–
Housepit 3														
Fill	–	–	–	26	–	–	2	6	–	1	–	1	2	4
Floor	–	4	–	121	–	–	–	–	–	–	–	–	1	–
Housepit 4														
Floor 1	–	1	–	53	–	7	2	–	–	1	–	–	–	–
Floor 2	1	–	–	190	–	–	–	–	–	1	–	–	–	–
Occupation surface	–	1	–	89	2	–	–	–	–	–	–	–	–	–
Pit 6	1	1	–	214	1	–	–	–	–	–	–	–	–	–
Pit 7	–	–	–	15	–	–	–	–	–	–	–	–	–	–
Zone 3														
Occupation surface	1	1	–	54	–	–	–	–	–	–	–	–	–	–
Shell scatter	–	–	–	–	–	–	–	–	–	–	–	1	–	–
Zone 2														
Occupation surface	–	–	–	2	–	–	–	–	–	–	–	1	–	–
Shell layer A	–	–	–	–	–	–	–	–	–	–	–	1	–	3
Shell layer B	1	–	–	–	–	–	1	–	–	–	–	–	–	–

ZONE 5

Zone 5, the site's oldest zone, is best represented by features exposed in the northern block excavation (Figure 5-1). Here, a buried and partially destroyed housepit was exposed, as well as a large area of charcoal staining.

The charcoal stain (Feature 59), exposed on the far west side of the block, lies upon the surface of a coarse sand stratum, immediately above the basal cobble layer. Stratigraphically, it is the oldest feature at the site and has been radiocarbon dated to 5496±142 B.P. This demonstrates a Kartar Phase occupation of the site, but gives little indication of the activities involved. Only one bone fragment--that of a marmot--could be identified (Table 5-3). This feature may either represent part of an old living surface or perhaps a poorly preserved firepit; the fire-modified rock and charcoal supports both possibilities.

Housepit 1 is the second feature in Zone 5, dating to around 3600 B.P. Obscured and partially destroyed by the construction of Housepit 2, Housepit 1 was not well-defined in the field. Profile A in Figure 5-2 shows Housepit 1 as a steep-walled pit, dug 70 cm deep from the surface of a clay-loam stratum (DU III) which had covered the earlier occupation represented by the charcoal stain. (The stain is shown in the 54N profile, Figure 5-2). However, in the 56N profile (Figure 5-2) and in north-south profiles,the wall of Housepit 1 is not nearly as apparent, and of course, north and east walls are not visible at all due to the superposition of Housepit 2. A possible eastern edge (of floor or perhaps wall) was suggested by subtle matrix changes in the northeast corner of the block excavation, giving Housepit 1 a probable oval shape (Figure 5-3), about 5.5 and 6.5 m across.

The floor of Housepit 1 was exposed in four separate excavation units (Figure 5-3) as a thin layer of stained, compacted sand (Features 5, 30, 58, 60). This floor is dated to 3636±100 B.P. Bone, bone tools, and shell fragments are major components of this floor; their spatial distribution is discussed in the second portion of the chapter. Three pits are also associated with Housepit 1.

Pit 1 (Feature 42) clearly originates in the floor of Housepit 1 (Figure 5-4). It is a round pit, about 45 cm in diameter and 35 cm deep. Its fill was similar to the stained sand of the floor and contained only some bone fragments (Table 5-2). The radiocarbon sample from the floor of Housepit 1 was taken immediately above this pit. The eastern half of Pit 1 slumped before it could be excavated, a recurring problem which hampered investigation not only of Pits 1 and 2 but of the Housepit 1 floor in this area.

Because of the erosion of Housepit 1 and construction of Housepit 2, no floor of Housepit 1 was discovered in the southeast corner of the block excavation. Pits 2 and 3 are considered to have been associated with Housepit 1 because of their stratigraphic placement and the similarity in radiocarbon dates. We recognize the possiblity, however, that they may be exterior pits excavated in the interval between the occupations of Housepits 1 and 2.

Pit 2 (Feature 56) is a circular pit, dug into the coarse sand underlying Housepit 1. In profile (Figure 5-4), it resembles a deep bowl. Several distinct episodes of fill were discerned, with shell concentrated near the

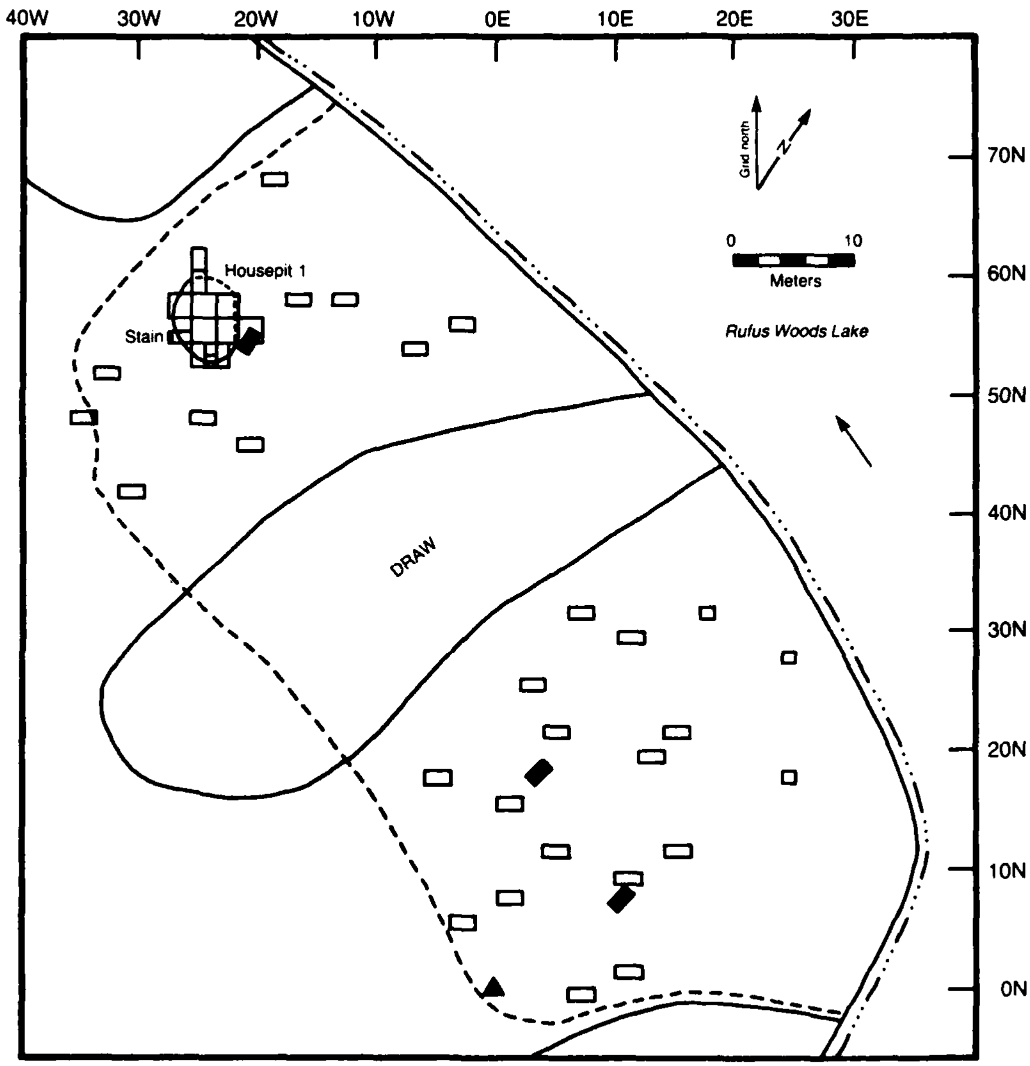


Figure 5-1. Features of Zone 5, 45-DO-211.

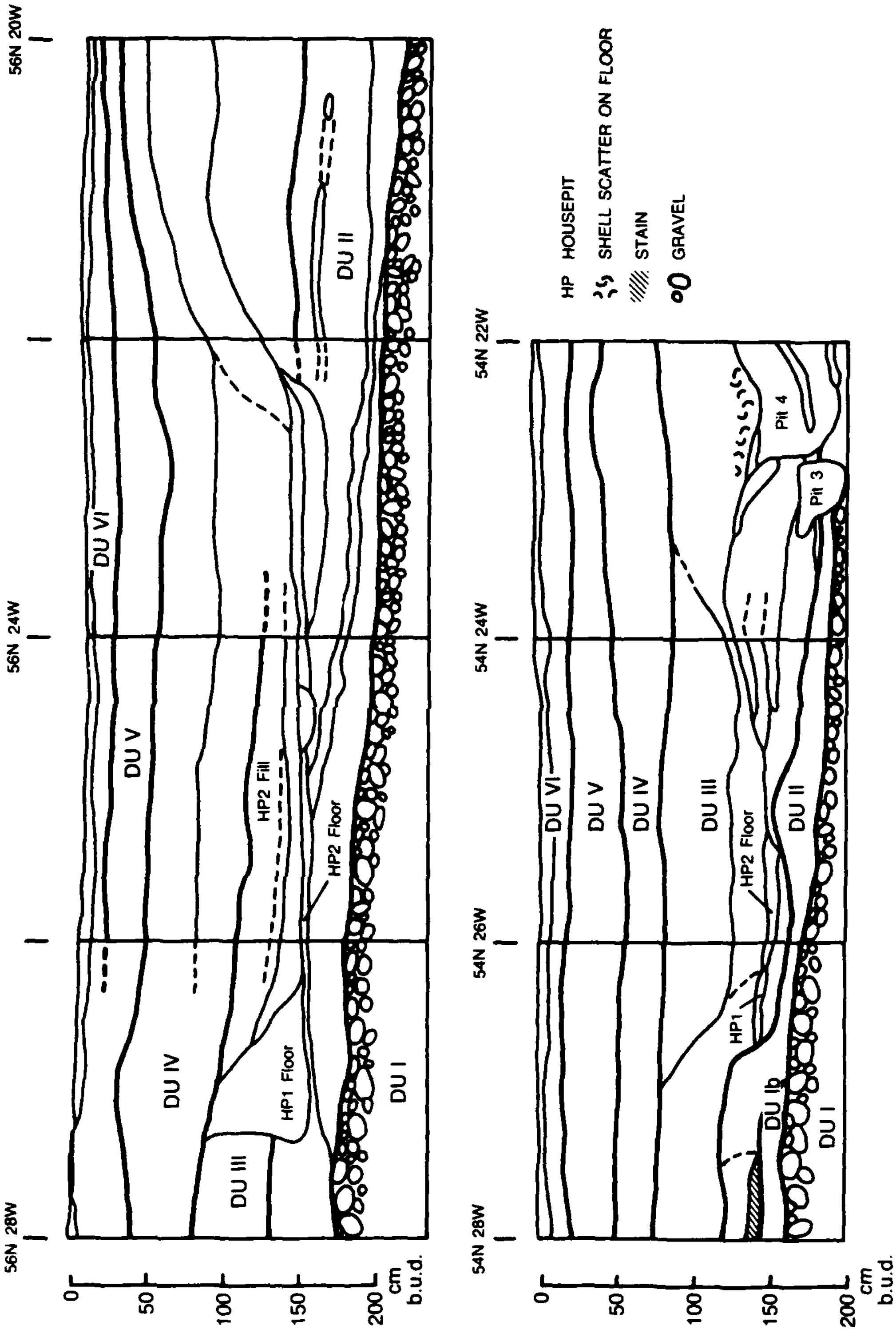


Figure 5-2. Profiles of 56N and 54N, 45-DO-211, showing Housepits 1 and 2.

middle of the pit and bone above and below the shell. The top of the pit apparently had eroded slightly leaving only large objects, such as the antler wedge (Table 5-2) in place, and then was covered by a layer of silt.

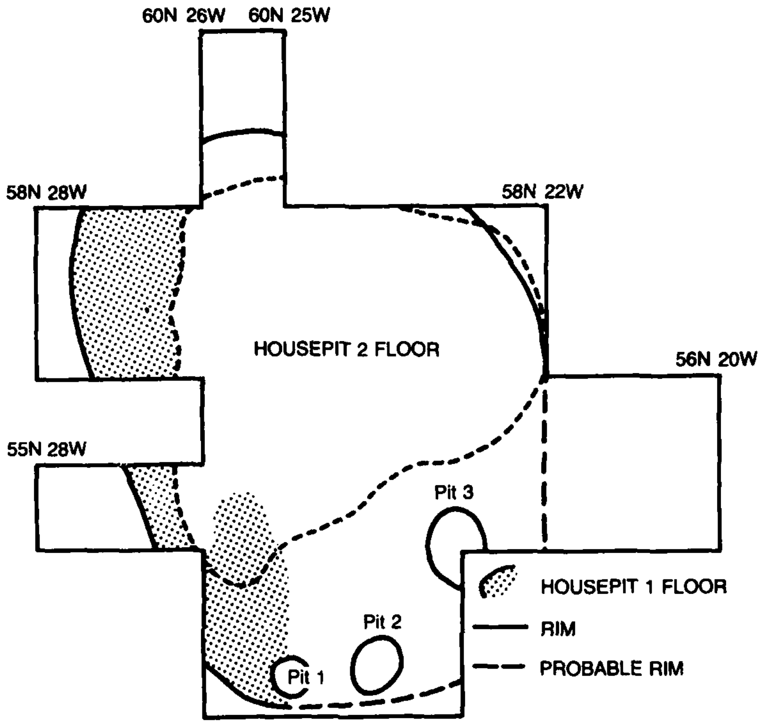


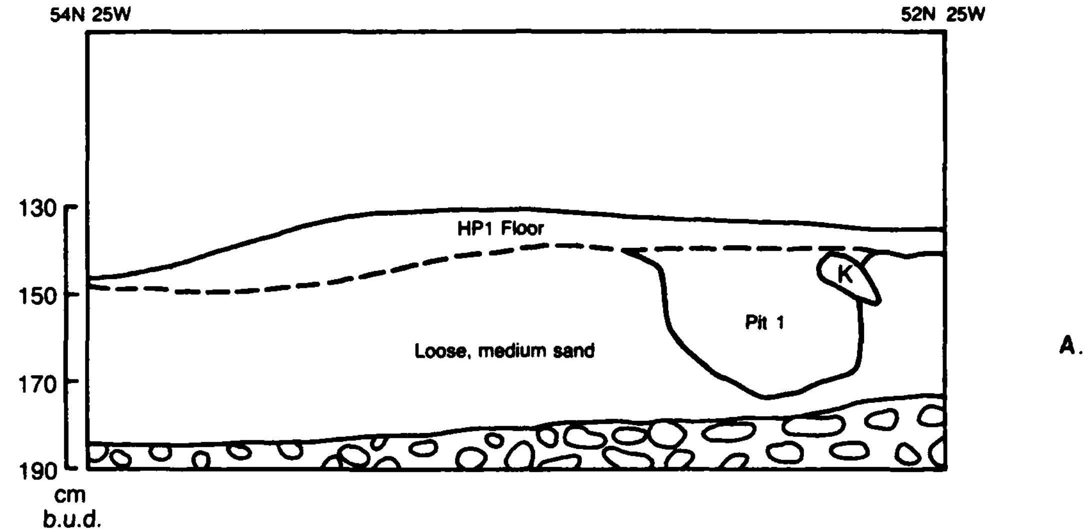
Figure 5-3. Housepit 1 (Feature 62) and related features at successive levels of excavation, 45-DO-211. (Short dashes indicate boundary of floor).

Pit 3 (Feature 29) contained mostly shell with small amounts of other debris (Table 5-2). We conclude that Pit 3 is associated with Housepit 1 on the basis of its radiocarbon date of 3505±74 B.P. which is nearly identical with the one taken from the floor (see Profile B, Figure 5-2). Pit 3 appears to have been a trash pit.

ZONE 4

Zone 4 encompasses the most intensive occupation of the site. Three housepits, an occupation surface, and an exterior pit were recorded (Figure 5-5). Spatial distributions, especially of salmon bone, are highly patterned.

Housepit 2 overlies Housepit 1 in the northern block excavation. It is an oval housepit, about 6 x 5 m across, and about 80 cm deep. Its walls were fairly steep on the upslope, or western side (Figure 5-2), but were more gradual and indistinct on the east. On the southeast side, rim and floor



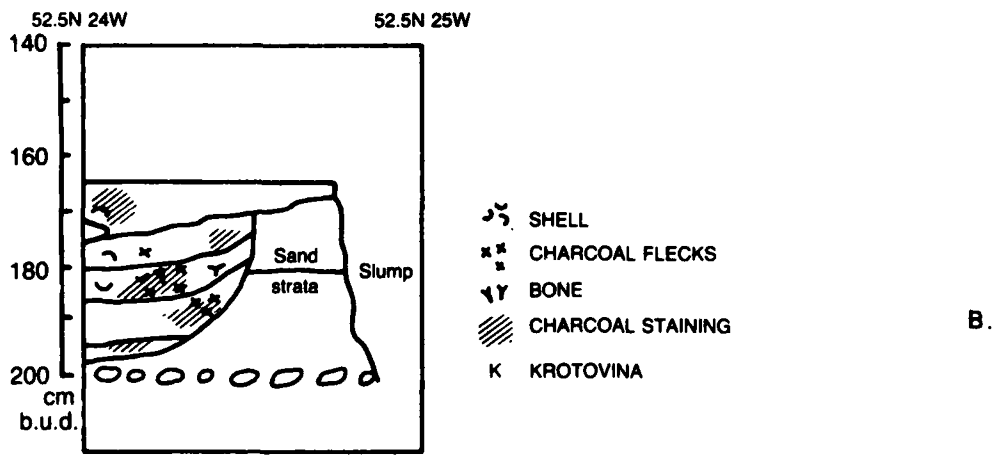


Figure 5-4. a) A portion of Housepit 1 floor (Feature 30) and nearby features. b) Profile of Pit 2, Zone 5, 45-DO-211.

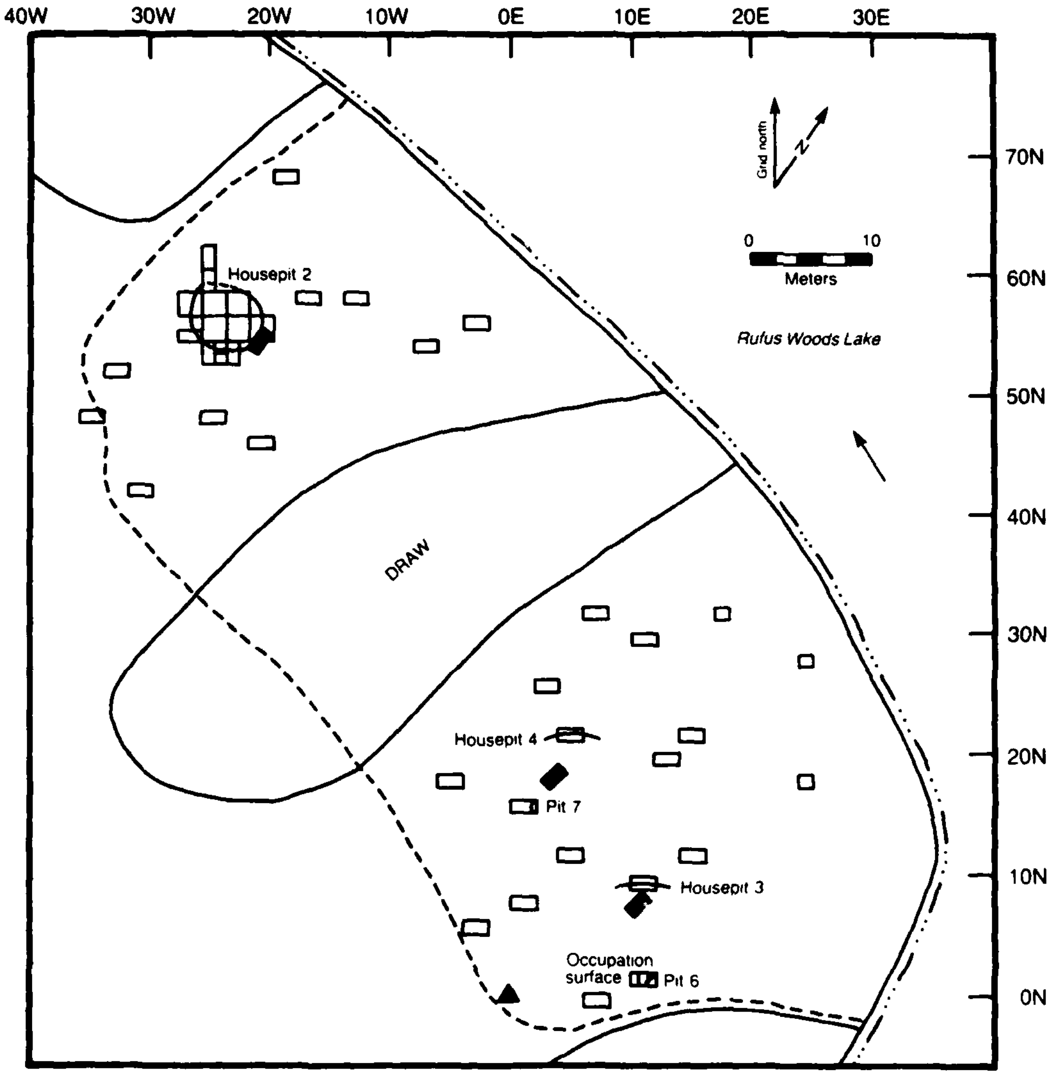


Figure 5-5. Features of Zone 4, 45-DO-211.

features were difficult to identify (Profile B, Figure 5-2); the housepit may have stood open for some time and eroded or its walls slumped after it was abandoned. A central hearth area and a large pit are the major interior features. A date of 2712±80 B.P. was obtained from a sample taken just west of the firepit/burned area. Tables 5-2, and 5-3 list the contents for the floor and fill of Housepit 2; these are zoned separately from the rest of the site (Zones 4:HP2 Floor and 3:HP 2 Fill, respectively), as discussed in Chapter 2.

Figure 5-6 shows the rim of Housepit 2, as well as the debris which littered the floor (Feature 13). A central hearth area is represented by a tight cluster of fire-modified rock (Feature 61), bordering a 1.5 m-diameter circle of oxidized sand. A cluster of shell (Feature 18) partially overlies Pit 4, a large pit in the southeast corner of the housepit. Other than these two clusters, debris seems to be fairly randomly distributed (see below for discussion of possible activity areas).

Pit 4 is a large pit in the southeast corner of Housepit 2. It underlies a shell cluster (Feature 18) which was part of the housepit floor. Although the floor of Housepit 2 was not observed by stratigraphers, Pit 4 can be seen in Profile B, Figure 5-2. This profile of a very complex stratigraphy seems to show Pit 4 as exterior to, possibly postdating, Housepit 2. The excavator and site supervisor concluded, however, that the pit and shell feature did originate in the Housepit 2 floor, and we concur with that judgment. Excavators recorded housepit floor (Feature 13) immediately above Pit 4, although it apparently was not visible in profile.

Pit 5 is a small pit (Figure 5-7) in the north wall of 58N25-24W. It was not noted during excavation and, no material was collected as part of it. Pit 5 measures 40 cm across at the top, 10 cm across at the bottom, and is 55 cm deep.

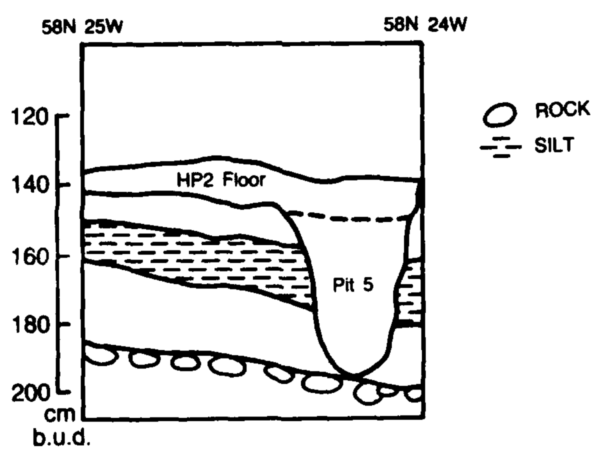


Figure 5-7. Profile of Pit 5, 45-DO-211.

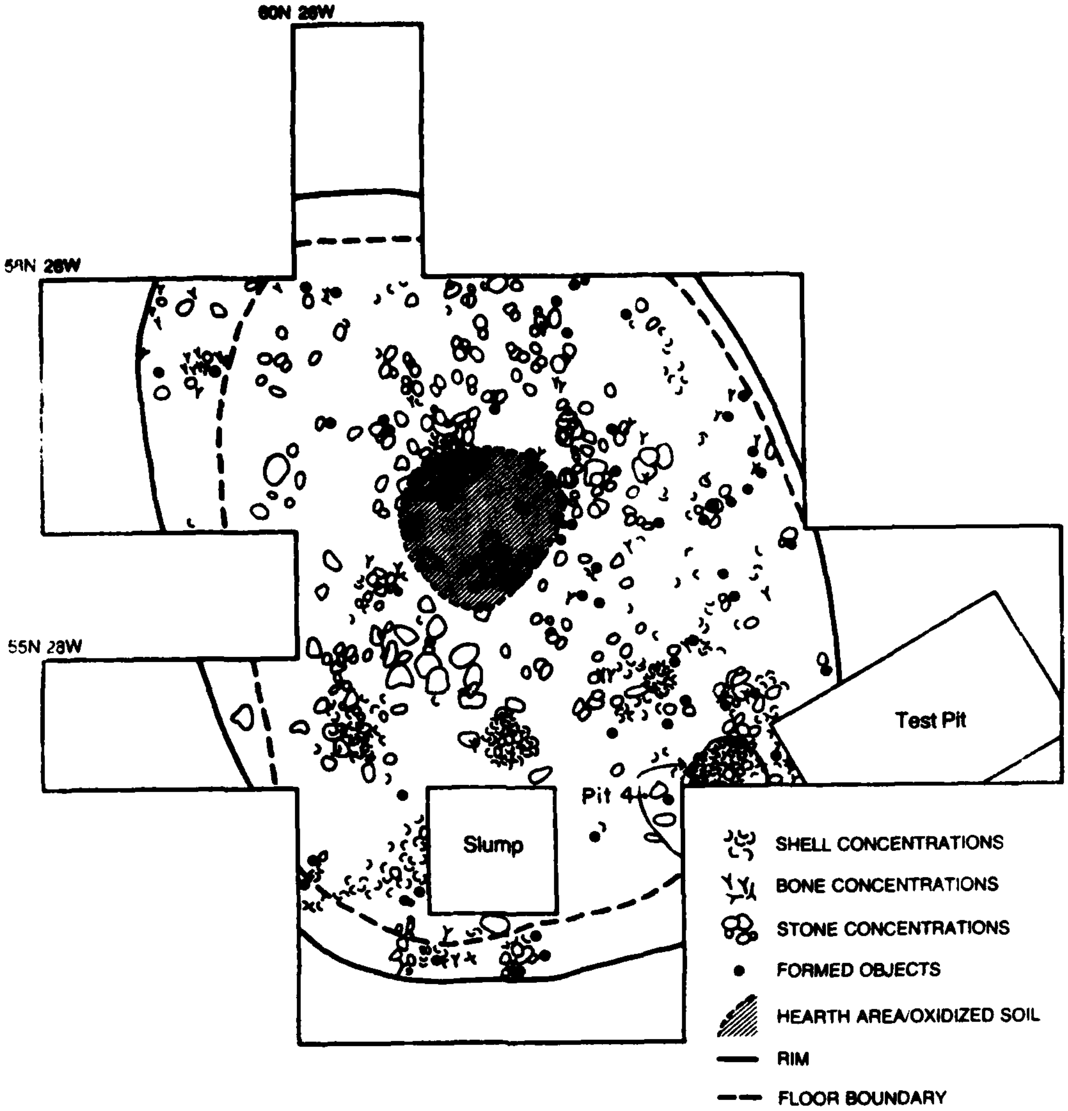


Figure 5-6. Plan map of Housepit 2 floor showing debris distributed in Levels 130-150 cm b.u.d., 45-DO-211.

Two noteworthy, and possibly related, aspects of the artifact assemblage from Housepit 2 are (1) the occurrence of projectile points, base and tips (Table 5-2) and (2) the complete absence of identified fish bone (Table 5-3). Deer-sized, deer, and elk-sized bone are the major identified fauna. It may be that the projectile points were lodged in carcasses that were carried into the housepit, as Brauner (1976) suggests happened at Alpowai. At the very least, it is intriguing that Housepit 2 should contain large animal bone fragments and projectiles, but no fish remains, while those housepits (Housepits 3 and 4) with large quantities of fish bone should yield very few identifiable large mammal bone and only one projectile point. The lack of identified fish bone in Housepit 2 is unusual for the zone, considering its abundance in other Zone 4 features (see below). Shell counts, too, generally are higher in other Zone 4 features than in Housepit 2 (Table 5-1).

Housepit 3 is a steep walled pit extending from 100 to 150 cm b.u.d. in 10N10E, (Figure 5-8). Both the floor and the lower 15 cm of fill were included in the feature designation. The housepit was exposed over a 50 x 200-cm area in the southern half of the unit. It also was exposed in Test Unit 1, one meter to the south. The pit is clearly distinguishable from the yellow, silty sand of the surface of origin. After its abandonment, it was filled in and covered by a later cultural stratum (Feature 19, assigned to Zone 3) that has been dated to 3117±119 B.P. This date was obtained from scattered charcoal in Level 130, 15-20 cm above the floor. The lower fill and floor of Housepit 3 is easily differentiated from the upper fill (Feature 19) by darker soils, an increase in shell, and the presence of articulated fish bone; 121 complete and fragmented salmonid vertebrae were recovered from Housepit 3 (Table 5-3). Figure 5-8 shows these vertebrae scattered, along with shell and FMR, on the exposed portion the floor.

Housepit 4 was defined during the analysis of feature and stratigraphic records. It appears as a very shallow depression, no more than 40 cm deep, in the stratigraphic profiles of 22N4E (Figure 5-9). The northwest corner of the depression appears to have been excavated. An occupation surface (Feature 43) with an associated hearth (Feature 38) and shell concentration (Feature 37) consitute the oldest floor within the dwelling (Figure 5-10). Floor 1 was also noted in Test Unit 2, two meters to the south, as a thin charcoal-stained deposit containing a lot of shell. A second floor (Feature 26) is separated from the first by 10 cm of silty sand. A carbon sample from the sand, but on the same excavation level as Floor 1, is dated to 2781±116 B.P., nearly the same date as that of Housepit 2.

Like Floor 1, Floor 2 is marked by charcoal staining, salmonid bone, and augmented counts of FMR. Shell is less than on Floor 1 (Table 5-1). Forty-three fire-modified rocks were among the material collected. No formed tools were recorded. As can be seen in Figure 5-11, the distribution of FMR on Floor 2 is patterned, suggesting a hearth area. Floor 2 is evidence of reuse of Housepit 4 not long after the deposition of Floor 1; it was followed by at least two other occupations (see below).

Aside from the three housepits and their associated features, three other features occur in Zone 4. These are an occupation surface and two pits.

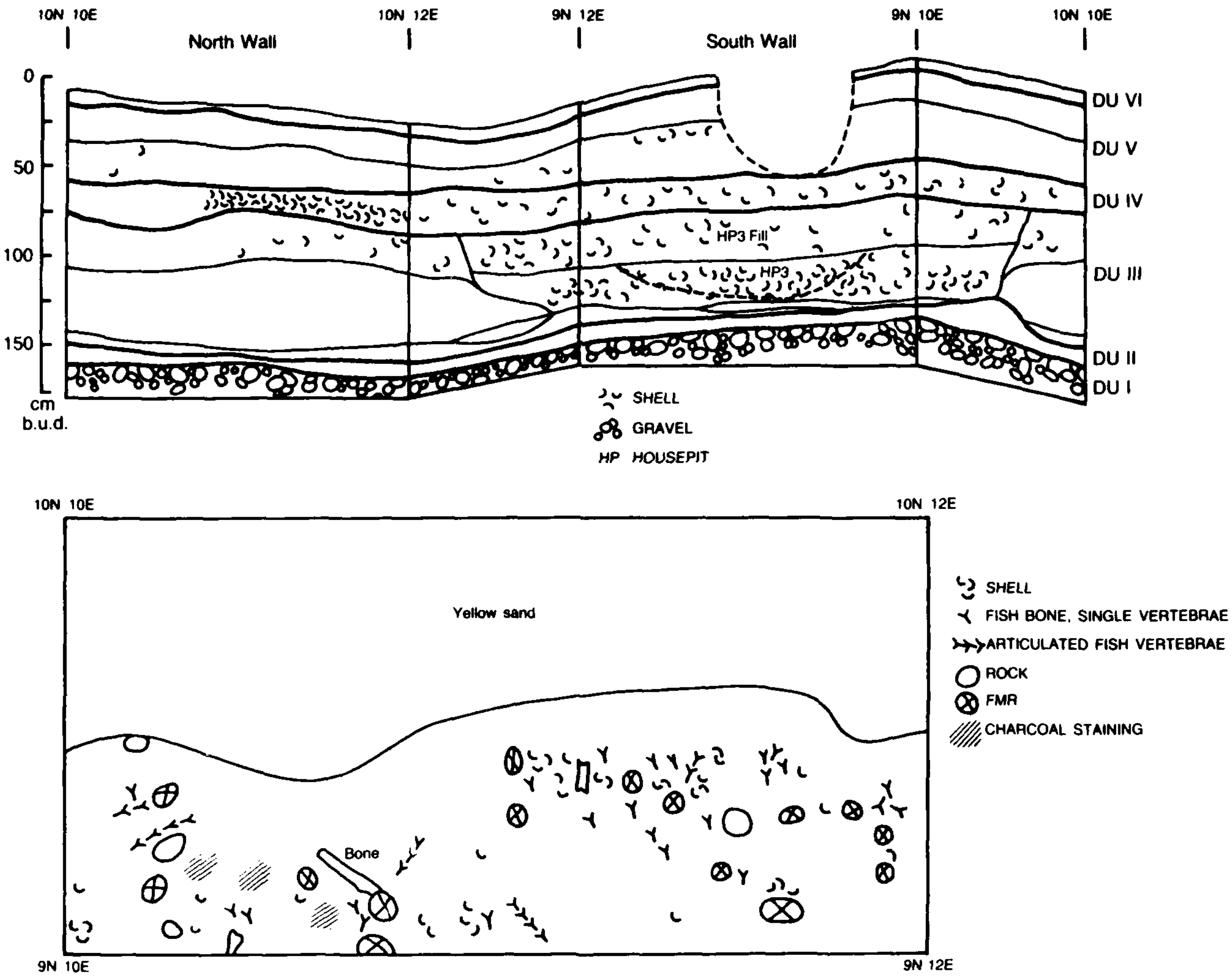


Figure 5-8. Profile and plan of Housepit 3, 45-DO-211.

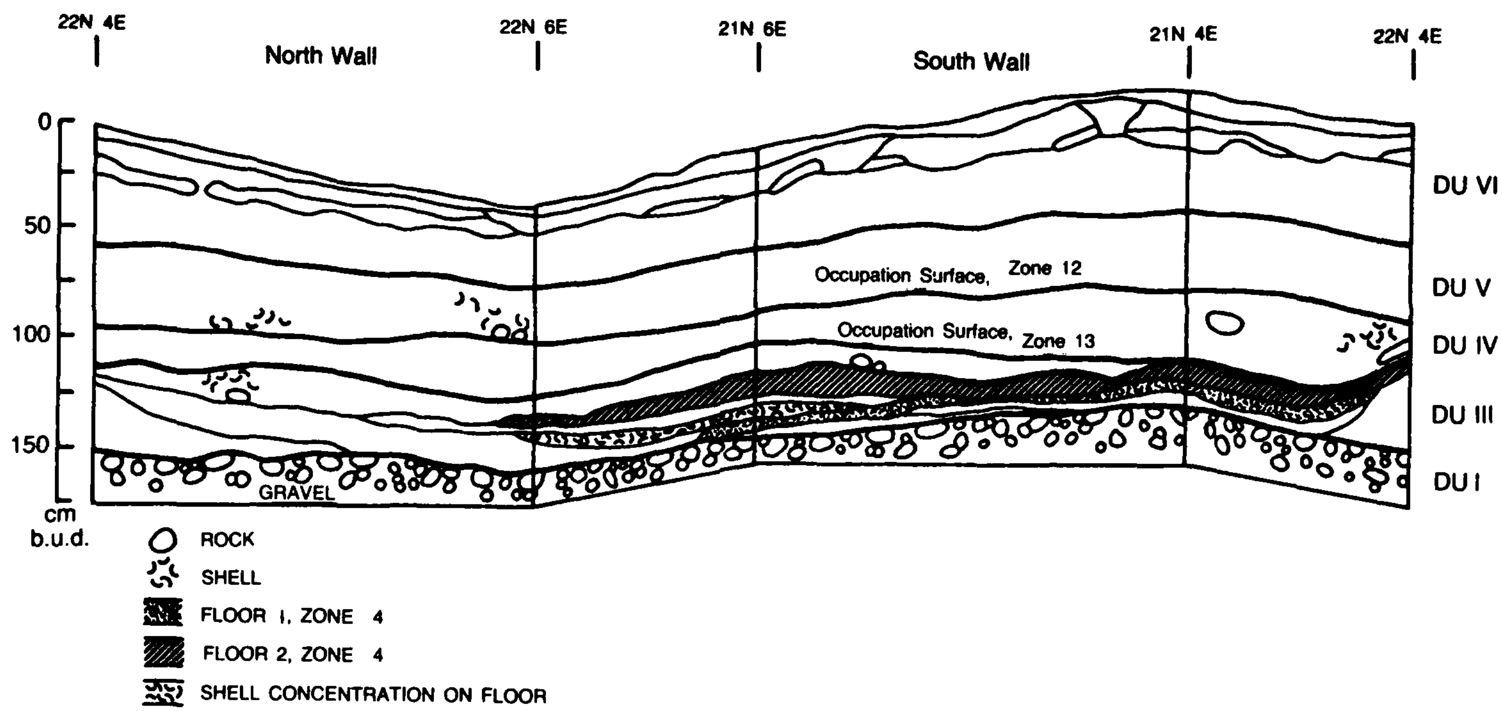


Figure 5-9. Profile of Housepit 4, 45-DO-211.

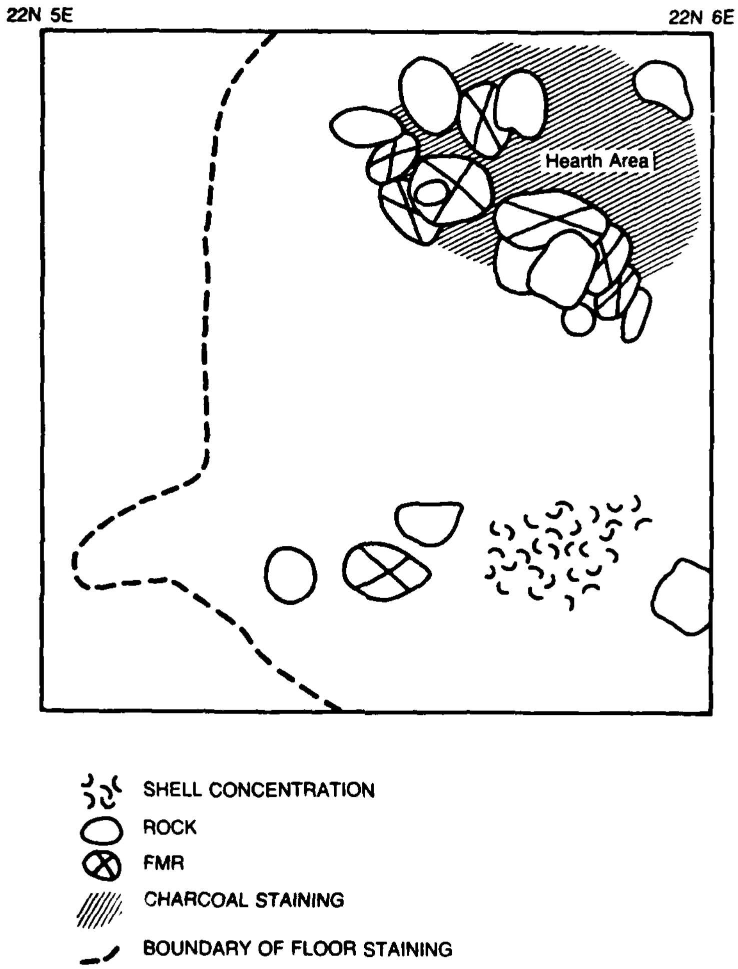


Figure 5-10. Plan of Floor 1, Housepit 4, 45-DO-211.

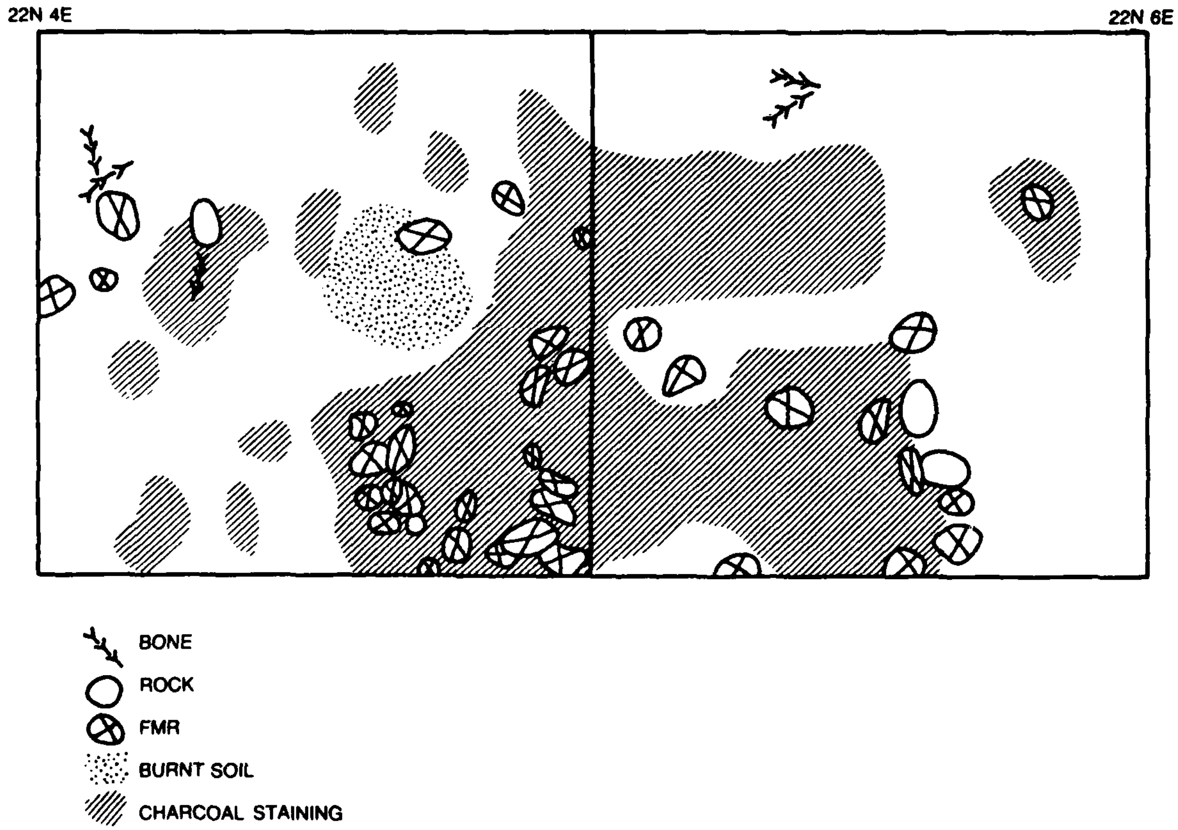
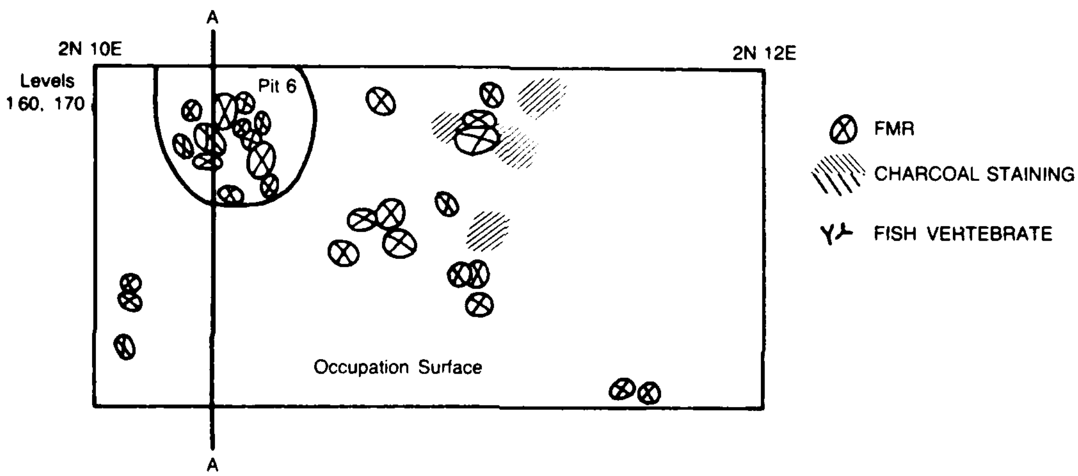


Figure 5-11. Plan of Floor 2, Housepit 4, 45-DO-211.

The occupation surface (Feature 28) was uncovered at 160 cm below the surface in 2N10E. Its charcoal staining differentiates it from upper unit levels. Its plentiful fire-modified rock exhibits no patterning (Figure 5-12), nor does its bone or shell. A shell bead, a utilized flake, salmon vertebrae and two chinook salmon otoliths were among the objects recovered.

Pit 6 (Feature 33) originates in the occupation surface and extends into the site's basal cobble layer (Figure 5-12). The pit's fill consists primarily of FMR, salmonid bone (including one chinook salmon otolith), and charcoal staining. None of the identified fish and mammal bone shows evidence of burning. Aside from the relative lack of formed objects, the contents and configuration of this occupation surface are very much like Housepits 3 and 4. It seems to us likely that it is actually an interior living surface; because no walls were exposed in the 1 x 2-m excavation unit, however, we cannot corroborate this.



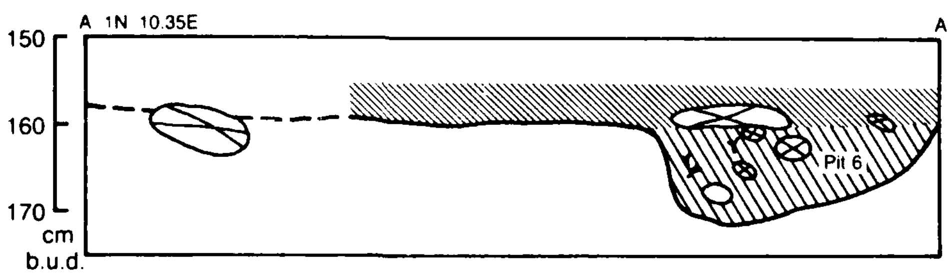


Figure 5-12. Plan and profile of Occupation Surface and Pit 6, 45-DO-211.

The last feature in Zone 4 is Pit 7 (Feature 8). Excavators first recognized Pit 7 as a semicircular stain in the southeast corner of 16N1E, beginning at the base of level 170 and extending to 176 cm b.u.d. Unit profiles, however, indicate the possibility of a pit beginning at approximately 138 cm b.u.d. with an area of charcoal staining (Figure 5-13). Below this is a layer of charcoal-flecked soil and then another area of staining. Only part of this lower area was excavated as Pit 7 (i.e., from 170-176 cm b.u.d.), and only materials recovered from this area are reported. However, because of the outline discerned in profile, we redefined the feature to include the entire pit. Characterized by heavy charcoal staining, articulated salmon bone, and mammal bone fragments, it may have been a roasting pit.

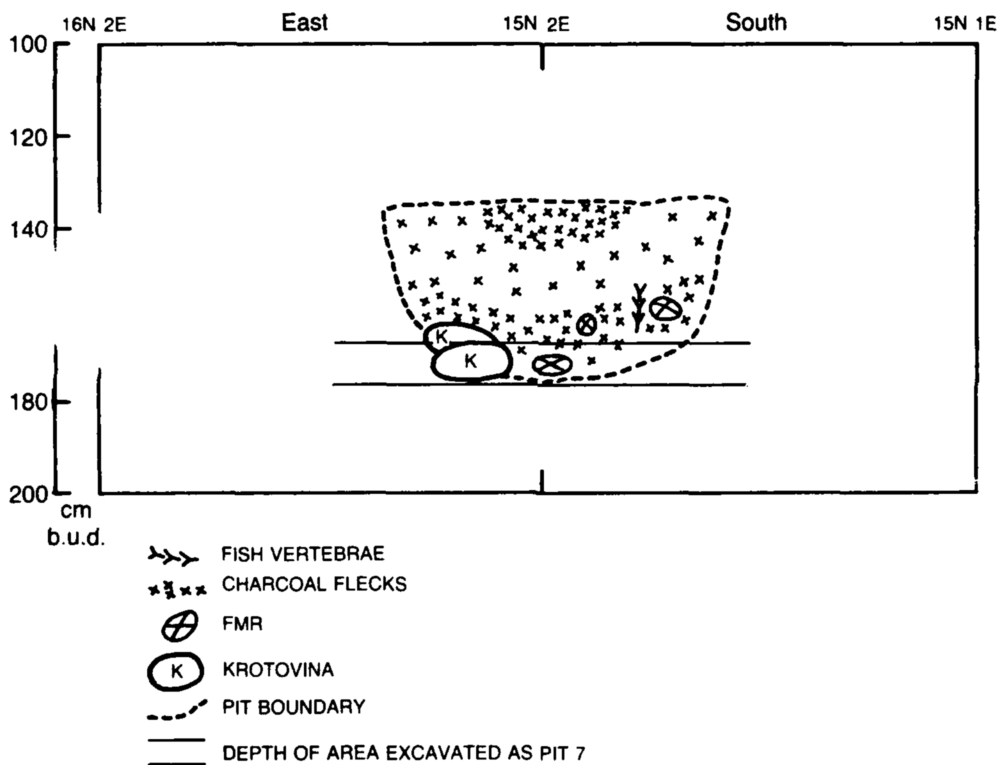


Figure 5-13. Profile of Pit 7, 45-DO-211.

ZONE 3

Features of Zone 3 (Figure 5-14) indicate much less permanent and intensive habitation than do those of Zone 4. Only one activity area, a shell scatter, and two poorly defined occupation surfaces can be postulated. Two

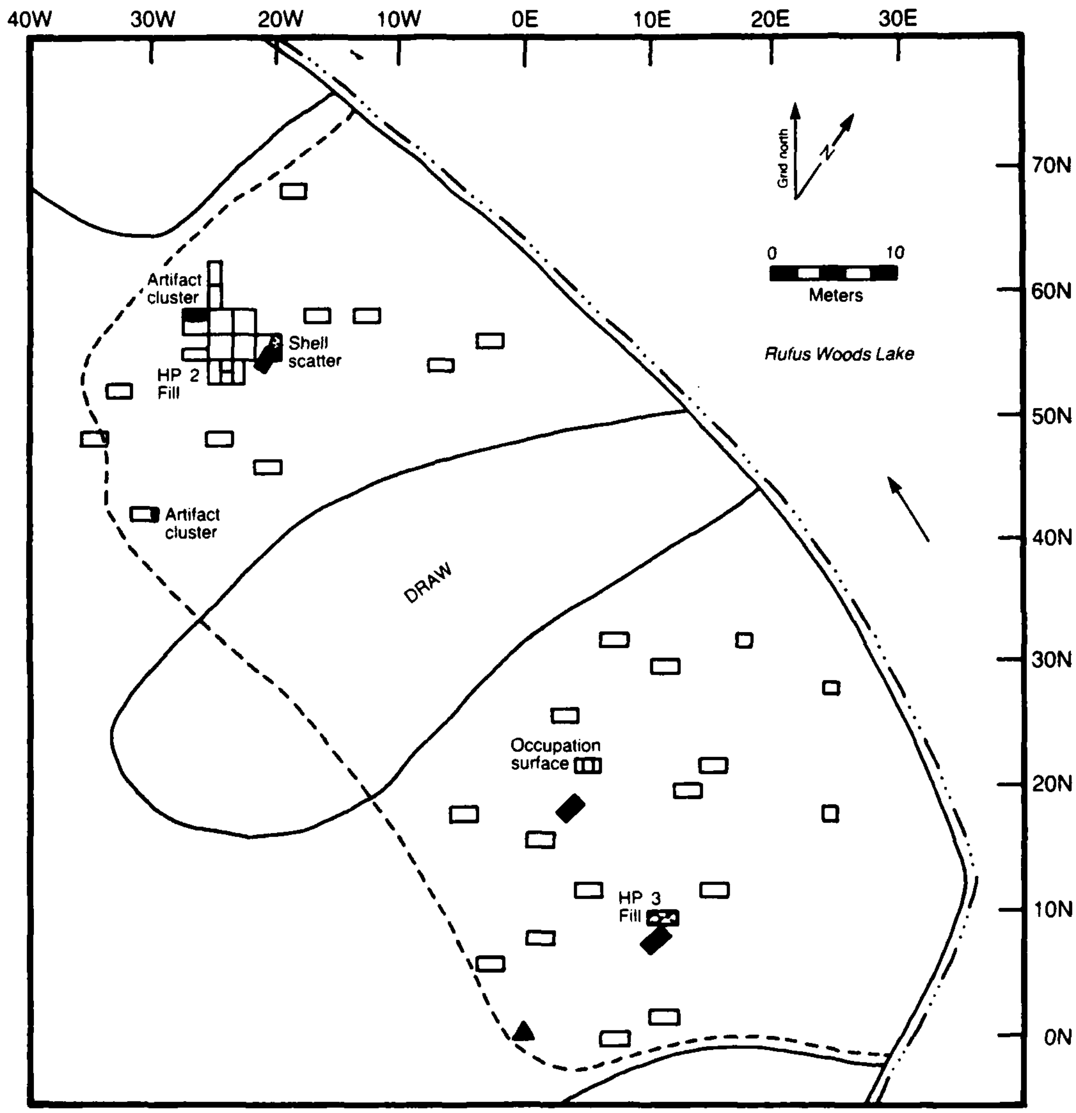


Figure 5-14. Features of Zone 3, 45-DO-211.

artifact clusters (Feature 1 and Feature 3) each contain a large millingstone and fire-modified rocks.

The occupation surfaces include a shell lens and possible compacted surface in the fill (Feature 19, levels 70 and 80, respectively) above Housepit 3, and a use surface 20 cm above Floor 2 in Housepit 4. Only the latter was recorded separately (Feature 23). It consisted of an unpatterned concentration of bone, FMR, and lithic debitage. Salmonid bone was recovered, but virtually no shell.

The first artifact cluster consists of a millingstone and fire-stained cobbles within a 60 x 70-cm area. Three pieces of shell adhere to the millingstone. It has a pecked area on one surface and possible weathered flake scars around the edges. The second artifact cluster consists of a millingstone, a flaked cobble, and four fire-modified rocks. The millingstone is an unshaped granite rock with pecking in the center on one side.

The shell concentration consists of two parts: a concentration of 40 shell hinges (Feature 46) in a 30 x 50-cm area in 56N21W, and small concentration of shell and FMR (Feature 47) immediately to the north. The two features appear to be a shell processing area and an associated hearth.

The features of Zone 3 indicate a marked shift away from the more permanent occupation of Zone 4. Evidence from these features and zone totals indicates interest focused primarily on gathering and processing of shellfish. The lack of shellfish on the use surface above Housepit 4 may indicate either that the feature was used at a slightly different season than other Zone 3 features or that it was used for a specialized activity.

ZONE 2

Two shell layers and an occupation surface are the cultural features of Zone 2 (Figure 5-15).

Shell Layer A (Feature 6) is a concentration of shell and FMR with associated cultural debris that slopes down steeply from west to east, as does the surface of the unit (Figure 5-16). Shell occurs in small concentrations throughout the feature. Bone is less abundant; the four pieces identified include one fragment of squirrel bone and three of pocket mouse bone. Of the 98 lithics, five showed signs of burning and three were dehydrated. This feature is a thick cultural deposit resulting from repeated episodes of shellfish processing on the sand dune in the southern area of the site.

Shell Layer B (Feature 45) is a sloping surface of shell that pinches out at its lower end. The stratum drops off quite sharply, at least 40 cm in a distance of 1.5 m (Figure 5-16). Lithic debris, FMR, and bone, were recovered, along with 6.6 kg of shell. The shell was in large pieces, mostly articulated, whole, and compacted together in clumps. Unlike Shell Layer A, which contains discrete clusters of shell, this shell midden represents either more intensive or more extensive (or both) use of shell at the site.

A second occupation surface (Feature 9) was noted above Housepit 4 in 22N4E. During excavation, this surface was noted primarily as an increase in cultural material, especially formed stone tools and bone. A subtle change in soils at the same level was noted by the stratigraphy crew (Figure 5-9).

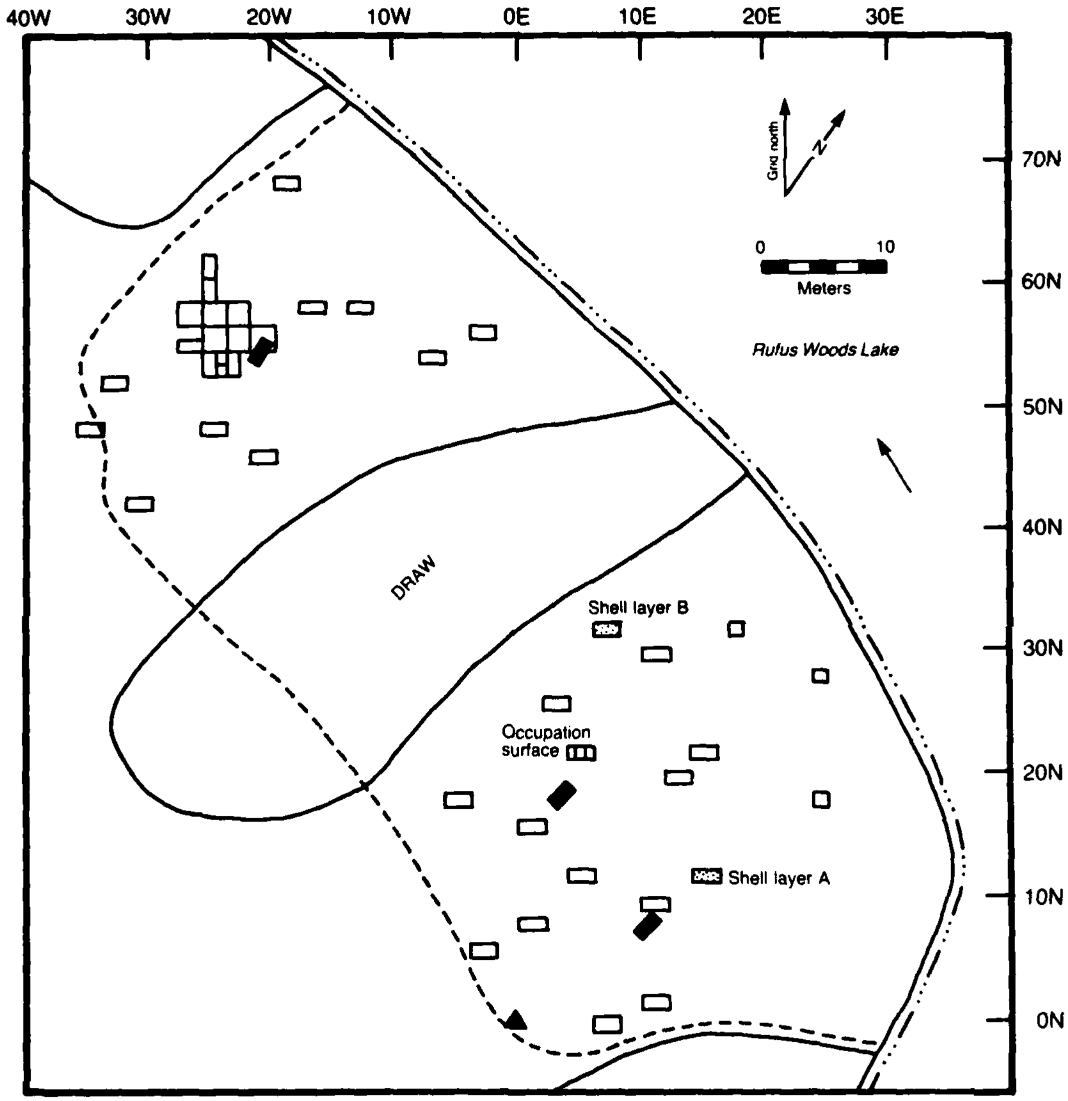


Figure 5-15. Features of Zone 2, 45-DO-211.

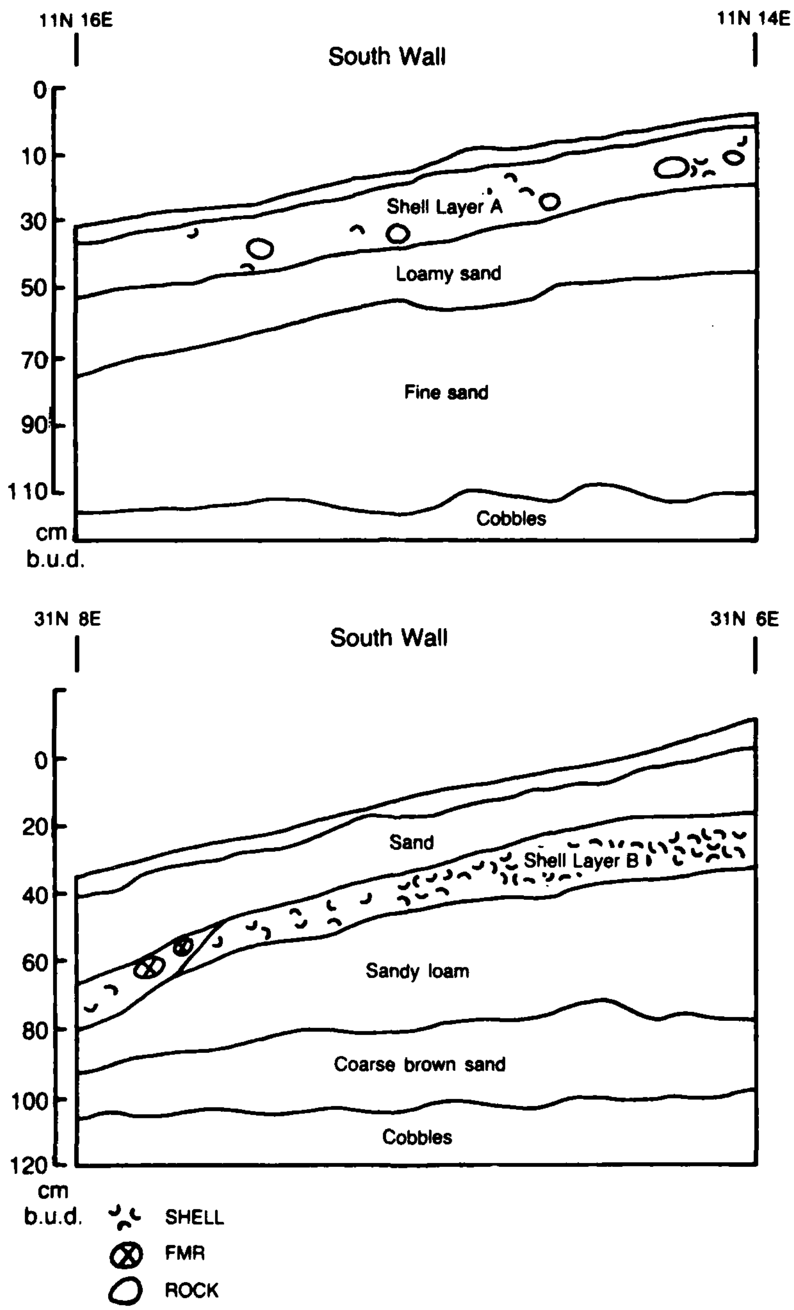


Figure 5-16. Profile of Shell Layer B, Zone 2, 45-DO-211.

Like the other living surfaces in Housepit 4, this occupation surface contained some fish bone. Unlike them, however, it contained almost no shell. Again, this surface may have been used either at a different season or for a different purpose than other areas on the site.

DISCUSSION: HOUSEPITS

Although a variety of feature types are recorded at 45-DO-211--housepits, exterior pits, shell concentrations, occupation surfaces--only the housepits occur in sufficient quantity and were recorded in sufficient detail for intra-site comparisons. Other types--pits, occupation surfaces--may be compared with similar features at other sites, a task we will undertake in the summary volume of the Project. For this report, we confine ourselves to a review of housepits at 45-DO-211. Three aspects of the housepits will be considered: structural details, possible activity areas within housepits, and differences in activities among housepits.

SIZE AND SHAPE

The structural dimensions of the four housepits at 45-DO-211 vary greatly, especially in wall construction and depth. This variation does not seem to be due to local physical factors, since all four housepits were excavated into basically the same depositional unit (a sandy loam, DU III), and all occur on about the same subsurface contour--the slope of the contemporary surface would have been about the same in all instances. The exception to this is Housepit 2 which, being dug into Housepit 1, was seated in a less stable matrix. This may explain the sloping walls of Housepit 2 as well as the marked post-occupational slumping.

The walls of Housepit 2 are moderately sloping (around 45°), while those of Housepits 1 and 3 are nearly vertical. All are deep pits, from 60-80 cm deep. It would appear that a substantial investment of labor was involved, at least in the digging of the pit; we have no evidence relating to the superstructure.

In these three housepits we have examples of what are traditionally assumed to be "winter" dwellings. Faunal assemblages however, indicate only spring through fall occupation (Chapter 4). The salmon recovered from Housepit 3 may restrict that even further to May and June.

Housepit 4 is more typical of what one might expect of a summer dwelling. Very shallow (less than 40 cm) with slightly sloping walls, Housepit 4 is little more than an occupation surface within a depression. It also serves as an example of the variation found in Hudnut Phase dwellings: some may not have been pit structures at all, but forerunners of the ethnographic, surface mat houses. The occurrence of salmon bone in Housepit 4 reinforces our assumption that it was used during the summer.

Although we have been able to summarize size and shape in profile for these housepits, we can say little about the plan view. Only Housepit 2 was excavated to expose floor and rim; only its size (5.5-6.5 m across) and shape (oval or subrectangular) are known (Figure 5-3). Housepit 1 was probably

slightly larger and similar in shape, judging from our tenous evidence, but no data are available for Housepits 3 and 4.

ACTIVITY AREAS

Only Housepits 1 and 2 were exposed sufficiently to discuss possible activity areas, and, even then, problems arise which must be considered in trying to determine such areas. Housepit 1 was only partially exposed in excavation; further, it was subject to erosion after its abandonment, and disturbed by the construction of Housepit 2. Housepit 2 itself was also subject to erosion and wall slumpage.

Housepit 1

Figure 5-17 shows the distribution of formed objects on the floor of Housepit 1. Bone tools are unusually common in the northwest corner. Figure 5-18 shows the distribution of cultural material in Zone 5 (it is not confined to Housepit 1). In Figure 5-18, we see that bone occurs frequently in the northwest and southern corners of the housepits; shell and FMR occur primarily in the southern corner. Higher shell and FMR counts are also associated with Pit 3 in the southeast corner. These distributions may indicate a meat-processing or bone-processing area in the northwest corner, while the floor and three pits along the south side of the housepit contain refuse.

Housepit 2

Figures 5-19 and 5-20 present the same information for Housepit 2. Worn or manufactured objects (Figure 5-19) cluster around the central hearth area and in the northern half of the structure. Tabular knives occur to the exclusion of other tools in the northeast corner; they are not associated with an abundance of any particular type of material (Figure 5-20). Also clustering around the hearth area are FMR (expectedly) and lithic debitage (Figure 5-20). The debitage and the formed objects may indicate tool production and maintenance in this area. Meat or bone processing seems to have been a major focus in the northwest corner and shellfish processing in the southeast corner, near Pit 4. Another concentration of shell is recorded in 54N26W (Figure 5-20), but it is not associated with any other features.

The data were not preserved which would allow for delineation of activities within the housepits beyond these rough outlines.

SPATIAL DISTRIBUTION: THE SUMMER FISHING CAMP

Two of the four housepits (Housepits 3 and 4), an occupation surface, and two pits, all on the south side of the site, contain abundant salmonid remains. Housepits 1 and 2, however, are nearly devoid of fish bone, and evidence instead greater reliance on large game. Why should this be so? Are these the result of seasonal differences or differences in the spatial distribution of activities on the site? The latter explanation assumes that the features within a single zone are contemporaneous, clearly an erroneous assumption. Instead, it appears that the four housepits at 45-DO-211

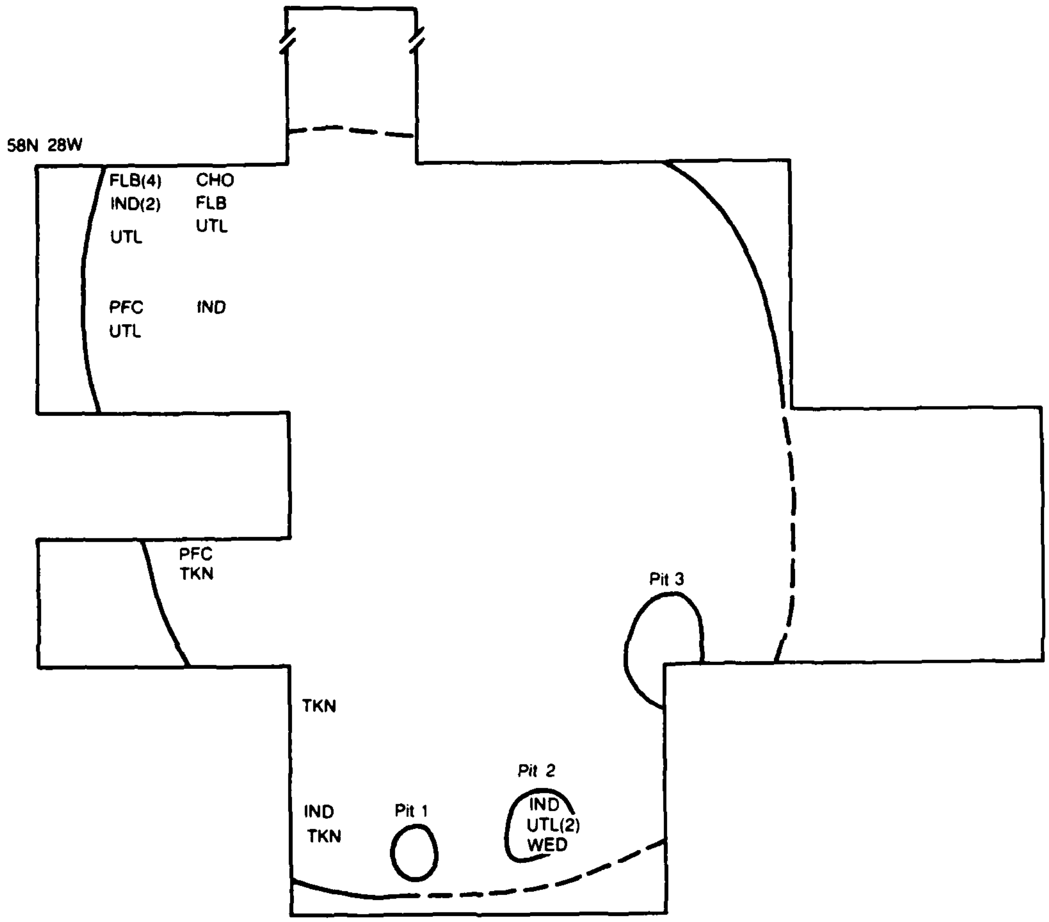


Figure 5-17. Plan of Housepit 1, 45-DO-211, showing features and location of worn and shaped artifacts.

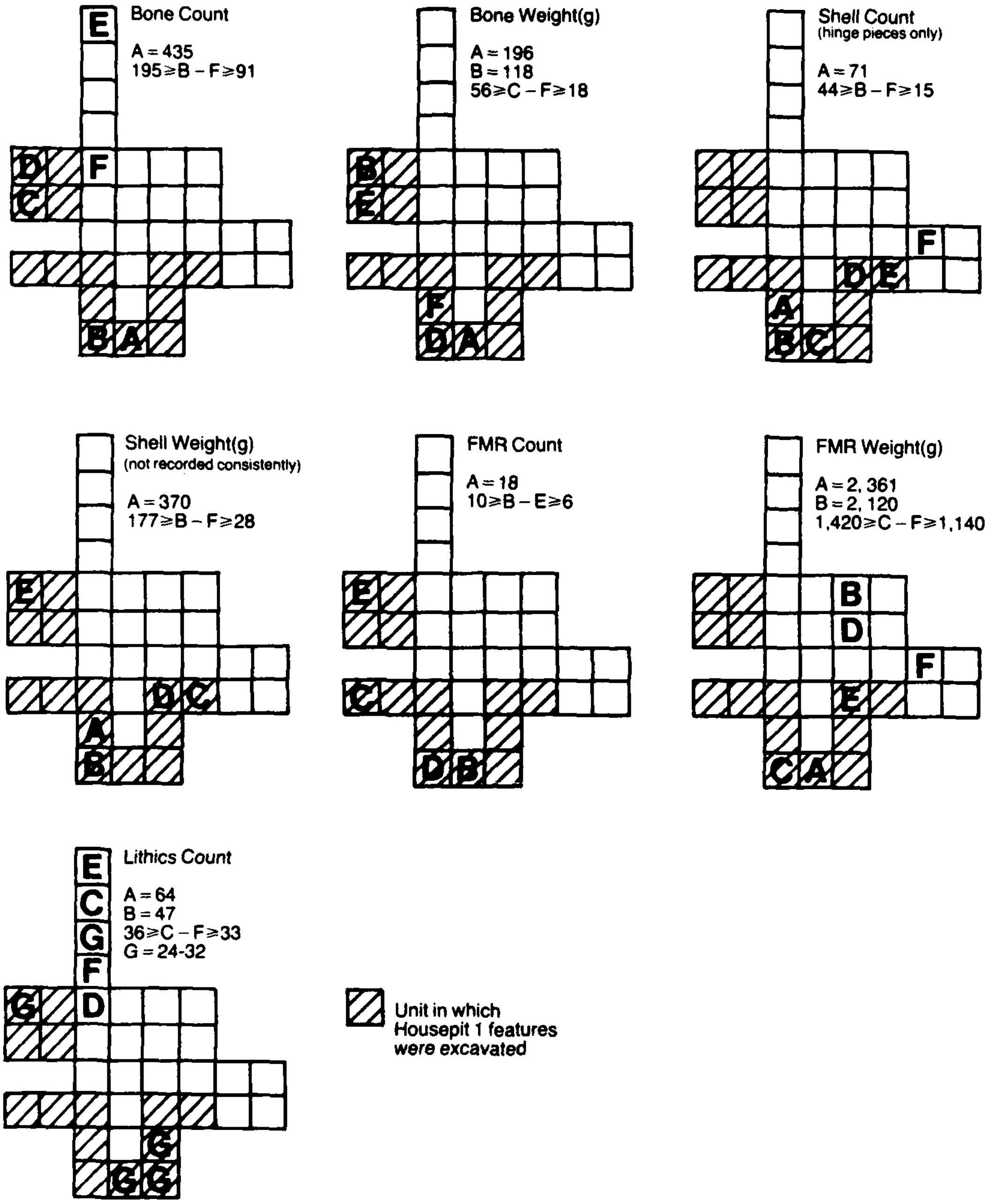


Figure 5-18. Distribution of material in Zone 5, 45-DO-211.

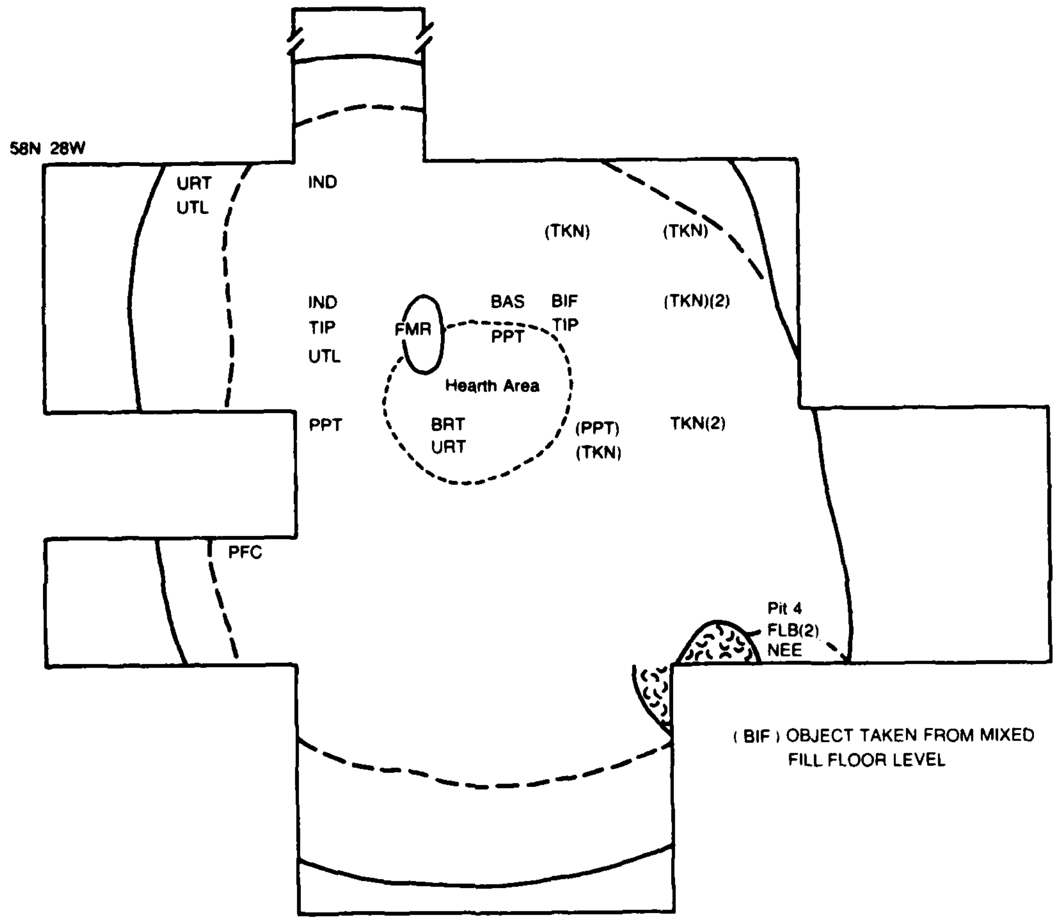


Figure 5-19. Plan of Housepit 2, 45-DO-211, showing features and location of worn and shaped artifacts.

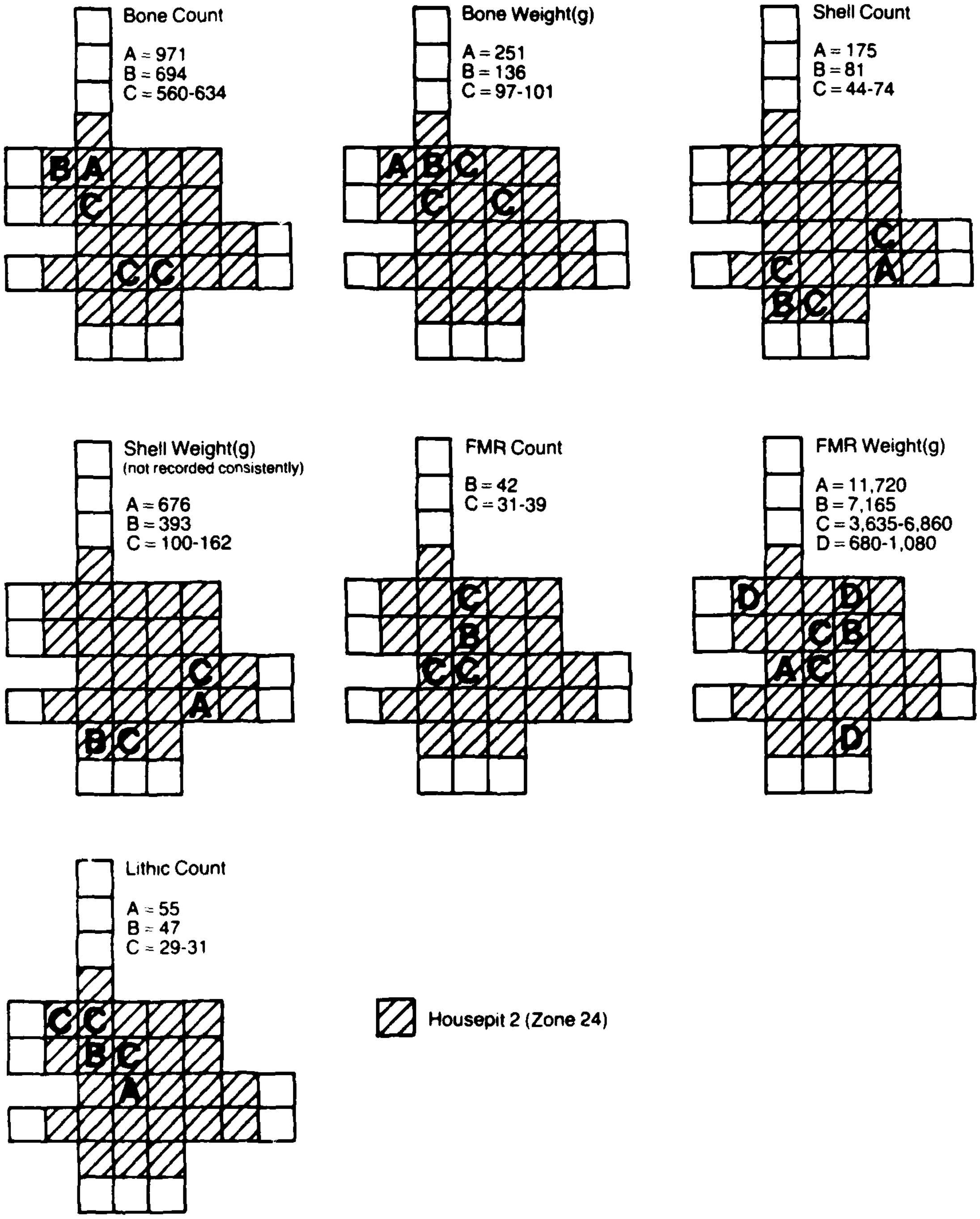


Figure 5-20. Distribution of material in Housepit 2, Zone 4:HP2 Floor, 45-DO-211.

represent different types of activities at different seasons of the year through the period between 3600-2700 B.P. Seasonal differences can also be inferred from the features in Zone 2 and 3.

Ray (1932) notes that the fishing season for the Sanpoil and Nespelem began around the first of May, and that some families built summer mat shelters at fishing grounds nearest their winter village (others sometimes went to major fishing spots, like Kettle Falls). The summer mat dwellings were rectangular, flat-roofed surface structures, enclosed on three sides, but open to the river. Fish were dried outside on racks on the upriver side of the house, but during the fall runs fish were dried within the enclosed structures by the heat of the fires. Ray (1932:28) implies that the group which occupied a local summer fishing camp was not large, being only a portion of the winter village community. He also states:

> the first bench above the river in most cases furnished the most desirable location for the group of summer [fishing] lodges. The individual houses forming the group were placed end to end, parallel to the river and facing it (1932:34).

Although the details of the ethnographic settlement have not been recovered at 45-DO-211, the site appears to have served as a summer fishing camp along the lines of the occupation described by Ray (1932). All four housepits are along the same subsurface contour of the site. One (Housepit 4) may even have been a surface structure similar to the summer mat dwellings, occupied and re-occupied several times. The other housepit containing abundant salmon remains (Housepit 3) is a more traditional semi-subterranean structure, but that does not preclude its use as a summer house during spring/summer fish runs; it also may represent an enclosed fall fishing structure. Housepits 1 and 2 contain little or no identified fish bone. As stated earlier, their assemblages are more notable for large mammal bone and projectile points. This suggests that they were not occupied during the fishing season, but may have been used for overwintering instead, although there is no conclusive proof of winter occupation (Chapter 4).

Radiocarbon dates indicate an alternating "winter" dwelling/fishing camp schema at 45-DO-211; the sequence of Housepit 1, Housepit 3, Housepit 2, Housepit 4 clearly shows the shift in site activity between hunting and fishing. It suggests that the ethnographic pattern observed by Ray (1932) was already in place by around 3000 B.P., but that having been established at a site, fishing did not remain the predominant activity there. Even within a single cultural phase or zone, a site may have been used for a variety of purposes which produced very similar archaeological remains, such as the four housepits at 45-DO-211.

6. SUMMARY AND CONCLUSIONS

45-DO-211 documents a prehistoric subsistence system at least 3,000 years ago which is quite comparable to that described by Ray (1932) for the local Sanpoil-Nespelem aboriginal group. The site was used as a winter camp and as a fishing camp during the summer and early fall. In both instances, dwellings were constructed and site occupation involved at least one household group, if not more, perhaps on the scale of a microband of several cooperating households. This is the only site in the project area which offers evidence of a summer fishing camp with housepits. Further, at least one housepit may well have been a surface mat lodge much like those described by Ray (1932) which were commonly constructed at favored camping spots where people exploited the heavy summer and fall runs of salmon. Four dated housepits, ranging in radiocarbon age from ca. 3600-2700 B.P., indicate that site occupations probably never involved a large group, and that use of the site as a winter camp and as a summer fishing camp alternated with the season or over the course of a number of years. We have no indication that any of the housepits were contemporaneous, only that site use shifted back and forth over a fairly short span of time.

All four housepits date to and are marked by diagnostics indicative of the Hudnut Phase (ca. 4000-2000 B.P.) defined for the Rufus Woods Lake project area (Zone 4). A poorly defined occupation surface, dated to the Kartar Phase (ca. 7000-4000 B.P.) is the only evidence of earlier occupation (Zone 5). Three zones were identified above the Hudnut Phase housepit occupation. No radiocarbon dates are available for these zones, but diagnostic artifacts place activities in Zones 3 and 2 in the Hudnut Phase, sometime after the 2700 B.P. date from the housepit occupation. There follows a hiatus of several thousand years, and then, in the uppermost zone of deposition, are numerous artifacts deposited by historic Euroamerican homesteading, placer mining, grazing, and hunting activities.

On a low terrace overlooking the Columbia River and just west of perennial Sanderson Creek, the site afforded an excellent strategic point from which inhabitants could have exploited a wide variety of terrestrial and riverine resources. Analysis of bone from the prehistoric levels of the site evidence all extant local taxa except mountain sheep (_Ovis canadensis_). Numerous large mammal bone fragments and abundant salmonid bones document a heavy emphasis on both hunting of artiodactyls and fishing for salmon. Inferences about season of occupations are difficult to make: available indicators place human activity throughout the year in most zones. A small sample of deer bones (_Odocoileus_ sp.) shows at least one set of activities confined to winter and spring or December through May (Table 4-3). The

salmonid bone in Housepits 3 and 4 indicate use of these dwellings during the salmon runs of early-late summer or fall.

Intensity of site use is borne out by the recovery of over 37,000 individual artifacts. Bone fragments total 21,149; shell fragments, another 9,793. Stone artifacts, including formed objects, flakes, and assorted debitage, total 5,504. Of that total, 5,110 are discarded flakes, evidence of considerable tool manufacture and repair. Worn or manufactured objects total 386. More than 1,400 fire-modified rocks were recovered from cultural features and general site matrix. Twenty-three cultural features (Table 5-1) include the four housepits mentioned above, and four occupation surfaces, seven pits, three shell scatters, and two clusters of in situ artifacts. By far the majority of the cultural features and other artifacts are assigned to the housepit occupation in Zone 4, and to other Hudnut Phase occupations in Zones 3 and 2.

ZONE 5

Zone 5 is best seen in the northern block excavation that includes Housepits 1 and 2. All identified cultural features lie in fine interbedded overbank deposits (DU III), above the basal cobble layer and below the loam and silt strata designated Zone 4. The earliest evidence of occupation is a thin, sandy surface with heavy charcoal stain, some bone fragments, and two fire-modified rocks (5497±142 B.P.). Just above this surface is the outline of Housepit 1, greatly confused by the superposition of Housepit 2. Housepit 1 appears to approximate fairly closely the shape and areal extent of Housepit 2 (Figures 5-3, 5-6). It consists of steep side walls dug down about 70 cm from the top of a clay loam stratum to the coarse sand encompassing the earliest cultural occupation. The floor is simply that sandy stratum with no preparation of any kind. A high density of cultural material and some charcoal flecks (3636±100 B.P.) were found within the sandy floor. A small trash pit (Pit 3) on about the same level as the floor contained mostly shell and charcoal in a silty matrix (3505±74 B.P.). Two other pits are associated with Housepit 1. Cultural material found in these features includes tabular quartzite knives, a few salmonid vertebrae, deer-sized bone fragments, and fire-modified rocks.

At least two different cultural occupations are documented in Zone 5, beginning with occupation on the coarse sand surface about 5,400 years ago, and ending with the abandonment of Housepit 1 sometime after 3,600 years ago.

ZONE 4

Zone 4 contains most of the cultural features identified at the site. Unlike Zone 5, it was identified over most of the site area. It includes three of the four housepits, four of seven smaller pits, and a distinct occupation surface. Housepit 2, uncovered in the block excavation discussed above, was about 5.5 m in maximum diameter and oblong in shape. It was dug down from its point of origin about 80 cm to where its floor contacts the floor of earlier Housepit 1 and the earliest sandy occupation surface. Its

south and west walls slope down steeply, but the north and east walls slope in very gradually. This may reflect the original slope of the site surface, and indicate the structure was only partially dug into a low sandy bank or a depression formed in part by the collapsed Housepit 1. Its floor is a compacted silt layer with heavy charcoal stain and a large amount of cultural debris (Figure 5-2). In cross section, the floor is markedly dish-shaped, about 15 cm lower in the center than at the wall juncture. Floor debris includes whitetail deer bone, rodent bone, deer-sized bone fragments, elk-sized bone fragments, and a range of stone tools documenting hunting, butchering, and attendant bone, hide and meat processing activities. Several episodes of in-filling occurred after the structure was abandoned; the large quantity of cultural debris in upper levels of the fill suggest repeated site occupations after that date.

The fill of Housepits 3 and 4, located across the large placer mining scar to the east, also held high densities of cultural materials. These were identified only in profile during excavation. Housepit 3 is a steep-walled pit extending from 100 to 150 cm b.u.d. in unit 10N10E (Figure 5-8). The lower fill and floor are darkly stained and contain shell fragments, articulated fish bone, 83 complete salmonid vertebrae, 38 salmonid vertebrae fragments, deer-sized bone fragments, two tabular quartzite knives, and a unifacially retouched flake. Housepit 4 is a shallower pit, less than 40 cm in depth from its point of origin, recognized in profile in unit 22N4E (Figure 5-9). It holds two distinct occupation surfaces. Floor 1, identified as charcoal-stained silt, contains a hearth, and a flaked mammal long bone, a polished bone object, retouched tabular flakes, numerous unidentifiable terrestrial bone fragments, and sucker and salmonid bones. A shell concentration directly associated with both the lower living surface and the hearth (Figure 5-10) contains utilized flakes, salmonid vertebrae and vertebrae fragments, deer-sized bone fragments, two painted turtle bones, and a marmot bone fragment. The hearth itself consists of charcoal stain, eleven fire-modified cobbles, angular rocks and cobbles, terrestrial bone fragments, three complete salmonid vertebrae, salmonid vertebra fragments, and a single utilized flake.

Other features in Zone 4 include a roasting pit (Pit 7) (16N1E) and pit (2N10E) associated with a thick use surface (2N10E). The roasting pit shows heavy charcoal stain mixed with fire-modified rock and contains articulated salmonid bone and mammal bone fragments. The other pit, found just above the basal cobble layer, produced fill consisting primarily of fire-modified rock, with 215 identified salmonid bones and two deer-sized bone fragments. The associated occupation surface is characterized by heavy charcoal stain and fire-modified rocks in abundance; it also contains numerous shell and bone fragments, a dentalium shell bead, a utilized flake, salmonid vertebrae, and two chinook salmon otoliths. The debris distribution has no apparent pattern.

Zone 4, like Zone 5, documents numerous occupations at the site; however, the widely dispersed excavation units, and hence, excavation contexts, largely preclude conclusive statements of association or stratigraphic position. Each housepit may represent a different episode of activity at the site, as might each cultural feature that has no direct association with a living floor. The

number of features and the densities of cultural materials do indicate that Zone 4 represents the most intensive occupation at the site.

ZONE 3

Cultural features within Zone 3 are smaller and less patterned than those observed in Zones 4 and 5. Only one activity area was identified: it is represented by a concentration of shell hinges and a single flake in a 30 x 50-cm area in unit 56N21W. The shells are in a layer about 8 cm thick; they are associated with fire-modified rocks, a single ground squirrel bone and a peripherally flaked cobble. These may evidence a single meal. Other possible evidence of single, short-term activities consists of two millingstone associations. One has a millingstone with three shell fragments adhering to it, directly associated with a small pile of fire-modified rocks (58N28W). The other is a large millingstone next to a scatter of fire-modified rocks (43N31W). No other artifacts were recorded in association with either feature. Other evidence of occupation is only found in poorly defined use surfaces or increases in cultural material in the fill of Housepits 2, 3, and 4.

Obviously, Zone 3 represents a different kind of prehistoric activity at the site than Zones 4 and 5. Evidence implies camping and short-term processing of specific resources rather than the more intensive, permanent residence pattern documented in the earlier Zone 4.

ZONE 2

Zone 2 essentially repeats the pattern outlined for Zone 3. A few, small cultural features indicate brief stays or short-term activities. A shellfish processing area has been defined in unit 12N14E on low sand dunes comprising the southern area of the site (Shell Layer A). It consists of several concentrations of shell and an associated squirrel bone fragment, three pocket mouse bones, a tabular quartzite knife, a hammerstone, fire-modified rock and lithic debitage. Another shell concentration in unit 32N6E consists of 2,690 pieces of shell, mostly in clumps of large, articulated pieces, with lithic debris, fire-modified rocks, unidentified bone fragments, a deer bone, and a marmot bone.

Zone 2 features suggest that the site area was used frequently as a stopping off spot where river mussels could be gathered and eaten, supplemented by other game.

ZONE 1

Zone 1 represents Euroamerican occupation: homesteads in the mid- to late nineteenth century, placer mining around the turn of the century, and homesteading, grazing, and hunting throughout this century (Thomas et al. 1984). Historic debris was found spread over much of the site, though architectural evidence was limited to the southern area. Just to the west of the site boundary was a an abandoned root cellar. Nearby, in the large placer

mining scar bisecting the site, a large number of historic implements were found, including a cast-iron wood stove.

No aboriginal cultural features were identified in Zone 1. Most historic artifacts were found loosely scattered throughout the upper 30 cm of site deposits, although some isolated specimens found as deep as 50-60 cm were recorded as part of Zone 2.

Perhaps the most interesting evidence recovered from Zone 1 is a flaked glass fragment and three glass flakes. This, coupled with the presence of aboriginal artifacts in the same zone, may indicate protohistoric occupation at 45-DO-211. This is, admittedly, only a speculation; we cannot posit any certain historical connection between aboriginal and Euroamerican inhabitants.

ARTIFACT ASSEMBLAGE

Although some differences in site use over time can be inferred from analysis of features, analysis of technological, functional, and stylistic aspects of the artifact assemblage have not produced patterns that distinguish one analytic zone from another. Technological analysis has supplied evidence of fairly consistent lithic reduction sequences regardless of zone. Functional analysis has shown similar uses of tools over the span of occupation at the site. Stylistic analysis has clearly placed site occupations within the late Kartar Phase (ca. 7000-4000 B.P.) and the early and middle Hudnut Phase (ca. 4000-2000 B.P.).

Complete lithic reduction sequences are evident: cores, primary and secondary flakes, and a wide variety of tool and object types were recovered. The site inhabitants seem to have made use of at least two sequences of tool manufacture. One industry focused on the use of cryptocrystalline, conchoidally fracturing stones, producing a wide variety of forms and contributing most of the stone tools and objects recovered from the site. It depended in large part upon stones that had to be brought to the site in partially reduced form, either cores, nodules, flakes, or blanks. The other industry focused on production of tools from locally available, noncryptocrystalline stones; the production of these tools required little investment of time or effort. Quartzite cobbles formed the basis of this industry; they supplied the tabular and nontabular flakes that were utilized for their sharp or steep edge and only occasionally resharpened. In general, site activities seem to have required flake tools, utilized and retouched, which were used in a variety of ways. Formed objects such as projectile points, bifaces, and knives are present, but in relatively low proportion.

Most tools show feathered and hinged chipping on working edges. Many show smoothing of the edge itself or of the feathered and hinged chipping patterns on the edge. Crushing or heavy attrition of edges is rare. Indeed, heavy cutting or pounding tools are absent from the upper three zones. Most tools are of the sort that would be used for light butchering and meat processing tasks--utilized flakes, knives, and scrapers. Wear patterns also indicate work in softer mediums such as hide, meat, and plant or woody fibers. That bone was worked, battered, and broken has been shown in Chapters 3 and 4. Even so, wear indicative of these types of activities is not prevalent.

Hinged chipping on edges may indicate cutting or contact with bone, but its presence on simple utilized flakes cannot be linked with any certainty to bone working or marrow extraction, activities that we know went on at the site. Activity areas representing manufacture or processing of hard materials may well be present at the site but sampling (or analyses) did not reveal any. Many bone fragments exhibiting butchering marks were recovered from the fill of housepit units; this could be debris thrown from nearby work areas. If this is so, the emphasis on light butchering activities derived from functional analysis of working edges may be quite misleading. These edges may be more characteristic of activities associated with exposed surfaces and structures than of the nature of activities across the site as a whole. Nevertheless, functional analysis has documented tool use on a variety of softer materials, with most evidence indicating butchering of game animals and the probable processing of plant species. An interesting association is the apparent correlation of tabular quartzite knives with riverine resources such as salmon bone and shell. Grabert (1968) and others have reported the association of tabular knives with shellfish processing. Wear on tabular knives, such as smoothing along one or more edges, cannot be precisely correlated with a single function; a wide range of uses, including the cutting and scraping of hides as well as the filleting or scaling of fish could produce such wear.

The consistency and general lack of change noted in technological and functional analyses may be a function of the fairly restricted span of occupation at 45-DO-211. Temporally diagnostic prehistoric artifacts consist solely of projectile point types, and these indicate only one cultural period, the Hudnut Phase (ca. 4000-2000 B.P.) defined for the Rufus Woods Lake project area. A single radiocarbon date documents an earlier, poorly defined occupation at ca. 5400 B.P. Lack of structured cultural remains in a clearly distinct context, however, means we can do little more than note that some short-term activity occurred during the Kartar Phase (ca. 7000-4000 B.P.). This was followed by use of the site as a housepit settlement in the Hudnut Phase, beginning ca. 3600 B.P. and continuing on to at least 2700 B.P. Rabbit Island Stemmed and Nespelem Bar projectile points in cultural deposits laid down after the most recent radiocarbon assay document continued use of the site as short-term hunting-gathering camps in the late Hudnut Phase. A hiatus of 2,000 years (Rufus Woods Lake Coyote Creek Phase, ca. 2000-200 B.P.), during which the site was not used, apparently follows. Historic Euroamerican artifacts document use of the site surface from the mid-nineteenth century to the present, with debris laid down by homesteading, placer mining and grazing and hunting.

IMPORTANCE TO REGIONAL PREHISTORY

Site 45-DO-211 is the only site in the Rufus Woods Lake project area that evidences the construction of prehistoric summer fishing settlements. Use of the site seems to have alternated between winter settlement (Housepits 1 and 2) and summer settlement (Housepits 3 and 4). A lack of identifiable fishing equipment (e.g., harpoon valves, leister barbs, net weights, etc.) may

indicate that fishing and many associated activities were carried on elsewhere along the river, perhaps at rapids surrounding Buckley Bar just downstream. On the other hand, the fishing tool kit may have consisted of perishable elements. The relative abundance of salmonid bone on the floors of Housepits 3 and 4 and the Zone 4 occupation surface may indicate that inhabitants ate salmon almost exclusively during the period that fish were being processed for storage. This would agree with Ray's (1932) description of summer fishing settlements among the ethnographic Sanpoil-Nespelem. Further, it is conceivable that salmon were being eaten only during the season of the salmon runs. This assumes importance in light of Schalk's (1983) suggestion that storage, or at least, enhanced storage of salmon for overwintering, led to higher prehistoric population densities and the permanent settlements characteristic of the rise of the so-called "ethnographic winter village pattern" (cf., Nelson 1969, 1973; Rice 1974). Yet, the two housepits, one a possible surface mat lodge, at 45-DO-211, seem indicative of a summer fishing settlement where inhabitants were most likely processing salmon for storage and eating large quantities of salmon in season. This would be in keeping with the findings at other sites in the project area (Jaehnig 1983a; Lohse 1984f; and Miss 1984c) which lead us to assume that intensive exploitation of the seasonal salmon runs characterized at least the last 5,000 years of archaeological record in the Rufus Woods Lake project area.

The winter settlement at 45-DO-211 during the Hudnut Phase has elements characteristic of other housepit settlements dating from ca. 5000-200 B.P. in the Rufus Woods Lake project area: variable kinds of housepits, tools and faunal/floral remains indicative of a broad-spectrum economy and winter or year-round activity, and settlement populations ranging from single households (one dwelling) to a small band (three to five contemporaneous dwellings). At 45-DO-211, we have no evidence that more than one dwelling was present on the site at any one time; and our inference that the housepits may be viewed as two winter dwellings and two summer dwellings is based entirely on the faunal remains. With the exception of the shallow, possible mat lodge, all housepits are deep and steep-walled. We can estimate shape, size and depth for Housepit 2: oval plan, ca. 5.5-6.5 m in diameter and 80 cm deep. Housepit 1 may have been of comparable size and shape, but since Housepit 2 cut and destroyed much of its original extent we cannot be sure. The presence of deep housepits and shallow surface structures is very similar to the range of dwellings recovered at 45-OK-11 some 13 miles downstream, and dated to the late Kartar Phase (ca. 5100-4200 B.P.) (Lohse 1984f).

Mule deer appear to have been the emphasized game in all seasons at 45-DO-211; artiodactyl remains are common on the floors of both Housepits 1 and 2, together with identifiable deer elements that indicate winter occupation. The Hudnut Phase housepit inhabitants also consumed a variety of small game, shellfish, and plant food--all of which could probably be obtained a very short distance from the site. Recovered tools are predominantly those associated with hunting, the butchering of meat, and hide processing (e.g., simple utilized and retouched flakes, projectile points, bifaces, tabular knives, and choppers). On the floor of Housepit 1, salmonid bone was recovered in direct association with artiodactyl bone; and this is indirect

evidence of the storage of salmon to supplement hunting in the winter months. Again, this economic pattern is reflected in other comparable site assemblages in the project area covering a span of at least 5000-200 B.P., and all three defined cultural phases.

Significant shifts in site use at 45-DO-211, from short-term camps (Kartar Phase) to winter and summer housepit settlements (Hudnut Phase) and back to series of recurrent short-term camps (late Hudnut Phase), are characterisitc of archaeological sites in the Rufus Woods Lake project area. We have every indication that prehistoric socioeconomic organization was generally consistent over at least the last 5,000 years, and that the locations of various economic activities routinely shifted up and down the length of the Columbia River within the project area (Jaehnig and Campbell 1984). Site 45-DO-211 is of particular interest because it suggests the existence of a specialized summer fishing settlement during the Hudnut Phase, ca. 3100-2700 B.P. Moreover, since sampling was not intensive and because the primary site deposits are not yet destroyed, further excavation may yield more insights. *Such an investigation would permit us to: a) state with more* assurance that 45-DO-211 does indeed represent a summer fishing settlement, and b) expose more fully spatial patterns and activity surfaces that are associated with the summer dwellings, and thereby more profitably compare this phenomenon with ethnographic descriptions of fishing and fishing settlements supplied by Ray (1932) and others. This would clarify the nature of cultural change involved in the postulated development of the "ethnographic winter village pattern" (Ames and Marshall 1980; Ames et al. 1981; Nelson 1969, 1973).

REFERENCES

Ahler, S.A.
1970 Projectile point form and function at Rodgers Shelter, Missouri. **Missouri Archaeological Society, Research Series** 8.

Ames, K.M., and A.G. Marshall
1980 Villages, demography and subsistence intensification on the southern Columbia Plateau. **North American Archaeologist** 2(1):25-52.

Ames, K.M., J.P. Green and M. Pfoertner
1981 Hatwai (10NP143): Interim report. **Boise State University, Archaeological Reports** No. 9. Boise.

Balme, J.
1980 An analysis of charred bone from Devil's Lair, western Australia. **Archaeology and Physical Anthropology in Oceania** 15:81-85.

Benfer, R.A.
1967 A design for the study of archaeological characteristics. **American Anthropologist** 69:719-730.

Binford, L.R.
1981 **Bones: ancient men and modern myths.** Academic Press, New York.

Bonnichsen, R. and R.T. Will
1980 Cultural modification of bone: The experimental approach in faunal analysis. In **Modern osteology**, edited by B.M. Gilbert, pp.7-30. Modern Printing, Laramie, Wyoming.

Brauner, D.R.
1976 **Alpowai: the culture history of the Alpowa locality.** Unpublished Ph.D. dissertation, Department of Anthropology, Washington State University.

Butler, B.R.
1961 The Old Cordilleran culture in the Pacific Northwest. **Idaho State College Museum, Occasional Papers** 5.

1962 Contributions to the prehistory of the Columbia Plateau. **Idaho State College Museum, Occasional Papers** 9.

Campbell, S.K.
1984a **Archaeological investigations at nonhabitation sites, Chief Joseph Dam Project, Washington.** Office of Public Archaeology, University of Washington, Seattle.

1984b **Archaeological Investigations at Sites 45-OK-2 and 45-OK-2A, Chief Joseph Dam Project, Washington.** Office of Public Archaeology, University of Washington, Seattle.

Campbell, S.K., editor
1984c **Report of burial relocation projects, Chief Joseph Dam Project, Washington.** Office of Public Archaeology, University of Washington, Seattle.

1984d **Research Design for the Chief Joseph Dam Cultural Resources Project.** Office of Public Archaeology, University of Washington, Seattle.

Casteel, R.W.
1974 Identification of the species of Pacific salmon (Genus Oncorhynchus) native to North America based upon otoliths. **Copeia** 1974:305-311.

Chance, D.H., and J.V. Chance
1982 Kettle Falls: 1971/1974. **University of Idaho, Anthropological Research Manuscripts Series** 69.

Collier, D., A.E. Hudson, and A. Ford
1942 Archaeology of the upper Columbia Region. **University of Washington, Publications in Anthropology** 9(1).

Couch, L.K.
1927 Migration of the Washington black-tailed jackrabbit. **Journal of Mammalogy** 8:113-114.

Crabtree, D.E.
1967a Notes on experiments in flintknapping: 4. tools used for making flaked stone artifacts. **Tebiwa** 10:60-73.

1967b The flintknapper's raw materials. **Tebiwa** 10(1):8-24.

1972 An introduction to flintworking. **Idaho State University Museum, Occasional Papers** 28.

1973 The obtuse angle as a functional edge. **Tebiwa** 16:46-53.

Dalquest, W.W.
1941 Distribution of cottontail rabbits in Washington State. **Journal of Wildlife Management** 5:408-411.

1948 Mammals of Washington. **University of Kansas Museum of Natural History, Publications** 2.

Damon, P.E., C.W. Ferguson, A. Long, and E.I. Wallick
1974 Dendrochronological calibration of the radiocarbon time scale. **American Antiquity** 39:350-366.

Daubenmire, R.F.
1970 Steppe vegetation of Washington. **Washington State University, Washington Agricultural Experiment Station, Technical Bulletin** 62.

Dunnell, R.C.
1971 **Systematics in prehistory**. Free Press, New York.

1979 Archaeological potential of anthropological and scientific models of function. In **Essays in honor of Irving B. Rouse**, edited by R.C. Dunnell and E.S. Hall, Jr., pp. 41-73. Mouton, The Hague.

Ernst, C.H., and R.W. Barbour
1972 **Turtles of the United States**. University of Kentucky Press, Lexington.

Flannery, K.V.
1968 Archaeological systems theory and early Mesoamerica. In **Anthropological Archaeology in the Americas**, edited by B.J. Meggers, pp. 67-87. Anthropological Society of Washington, Washington, D.C.

Flenniken, J., and E. Garrison
1975 Thermally altered novaculite and stone tool manufacturing techniques. **Journal of Field Archaeology** 2:125-131.

Franklin, J.F., and C.T. Dyrness
1973 Natural vegetation of Oregon and Washington. **U.S. Department of Agriculture, Forest Service, General Technical Report** PNW-8.

Frison, G.C.
1968 A functional analysis of certain chipped stone tools. **American Antiquity** 33:149-155.

Galm, J.H., G. Stevenson, and R.A. Masten
1980 A cultural resources overview of Bonneville Power Administration Mid-Columbia Project, Central Washington. **Washington State University, Laboratory of Archaeology and History, Project Reports** 5.

Gilbert, B.M.
1980 **Modern osteology**. Modern Printing, Laramie, Wyoming.

Grayson, D.K.
1984 The paleontology of Gatecliff Shelter small mammals. In The archaeology of Gatecliff Shelter and Monitor Valley, by D.H. Thomas. **American Museum of Natural History Anthropological Papers**, in press.

Greengo, R.E.
1982 Studies in prehistory, Priest Rapids and Wanapum Reservoir areas, Columbia River, Washington. Report to U.S. Department of Interior, National Park Service, San Francisco. University of Washington, Department of Anthropology.

Gullday, J.E., P.W. Parmalee, and D.P. Tanner
1962 Aboriginal butchering techniques at the Eschleman site (36LA12), Lancaster County, Pennsylvania. **Pennsylvania Archaeological Bulletin** 32(2):59-83.

Gunn, J. and E.R. Prewitt
1975 Automatic classification: projectile points from west Texas. **Plains Anthropologist** 20:139-149.

Gustafson, C.E.
1972 **Vertebrate faunal remains from the Marmes rockshelter and related archaeological sites in the Columbia Basin.** Ph.D. dissertation, Washington State University. University Microfilms, Ann Arbor.

Hall, E.R.
1981 **The mammals of North America** (2 Vols.). Willey, New York.

Hayden, B. (editor)
1979 **Lithic use-wear analysis.** Academic Press, New York.

Holmer, R.N.
1978 **A mathematical typology for archaic projectile points of the Eastern Great Basin.** Unpublished Ph.D. dissertation, Department of Anthropology, University of Utah.

Ingles, L.G.
1965 **Mammals of the Pacific states.** Stanford University Press, Stanford.

Jaehnig, M.E.W.
1983a Archaeological investigations at Site 45-OK-258, Chief Joseph Dam Reservoir, Washington. Ms. on file, U.S. Army Corps of Engineers, Seattle District.

1983b **Chief Joseph Dam Cultural Resources Project: preliminary report of field investigations, 1978-1980.** Office of Public Archaeology, University of Washington, Seattle.

1984a **Archaeological investigations at Site 45-DO-273, Chief Joseph Dam Project.** Office of Public Archaeology, University of Washington, Seattle.

1984b **Archaeological investigations at Site 45-OK-18, Chief Joseph Dam Project, Washington.** Office of Public Archaeology University of Washington, Seattle.

Jaehnig, M.E.W. and S.K. Campbell (editors)
1984 **Summary of results, Chief Joseph Dam Cultural Resources Project.** Office of Public Archaeology, University of Washington, Seattle.

Jermann, J.V., W.S. Dancey, R.C. Dunnell, and B. Thomas
1978 Chief Joseph Dam cultural resources management plan. Ms. on file, S. Army Corps of Engineers, Seattle District.

Johnson, R.J.
1978 **Multivariate statistical analysis in geography.** London: Longwan Group Limited.

Keeley, L.
1974 Technique and methodology in microwear studies: a critical review. **World Archaeology** 5:323-336.

1978 Microwear polishes on flint: some experimental results. In Lithics and subsistence: the analysis of stone tool use in prehistoric economies, edited by D. Davis. **Vanderbilt University Publications in Anthropology** 20.

Klecka, W.R.
1980 **Discriminant analysis.** Sage Publications, Inc. Beverly Hills.

Kurten, B., and E. Anderson
1980 **Pleistocene Mammals of North America.** Columbia University Press, New York.

Leeds, L.L., W.S. Dancey, J.V. Jermann and R.L. Lyman
1981 Archaeological testing at 79 prehistoric habitation sites: subsistence strategy and site distribution. Ms. on file, University of Washington, Office of Public Archaeology.

Leonhardy, F.C.
1970 **An evaluation of the archaeological resources in the Rufus Woods area behind Chief *Joseph Dam, Columbia River, Washington.*** *Report prepared* for U.S. National Park Service, San Francisco. Washington State University, Laboratory of Anthropology.

Leonhardy, F.C. and G.R. Muto
1972 **The Levallois technique on the Lower Snake River.** Paper presented at the 1972 Northwest Anthropological Conference, Portland.

Leonhardy, F.C., and D.G. Rice
1970 A proposed culture typology for the lower Snake River region, southeastern Washington. **Northwest Anthropological Research Notes** 4(1):1-29.

Leonhardy, F.C., G. Schroedl, J.Bense, and S. Beckman
1971 Wexplsnime (45GA61): preliminary report. Report to the National Park Service. **Washington State University, Laboratory of Anthropology, Reports of Investigations** No. 49.

Lohse, E.S.
1984a **Archaeological investigations at site 45-DO-204, Chief Joseph Dam Reservoir, Washington.** Office of Public Archaeology, University of Washington, Seattle.

1984b **Archaeological Investigations at Site 45-DO-211, Chief Joseph Dam Reservoir, Washington.** Office of Public Archaeology, University of Washington, Seattle.

1984c **Archaeological Investigations at Site 45-DO-242/243, Chief Joseph Dam Reservoir, Washington.** Office of Public Archaeology, University of Washington, Seattle.

1984d **Archaeological Investigations at Site 45-DO-282, Chief Joseph Dam Reservoir, Washington.** Office of Public Archaeology, University of Washington, Seattle.

1984e **Archaeological Investigations at Site 45-DO-326, Chief Joseph Dam Reservoir, Washington.** Office of Public Archaeology, University of Washington, Seattle.

1984f **Archaeological Investigations at Site 45-OK-11, Chief Joseph Dam Reservoir, Washington.** Office of Public Archaeology, University of Washington, Seattle.

1984g Rufus Woods Lake Projectile Point Chronology. In **Summary of results, Chief Joseph Dam Cultural Resources Project**, edited by M.E.W. Jaehnig and S.K. Campbell. Office of Public Archaeology, University of Washington, Seattle.

Lyman, R.L.

1975 Rufus Woods Lake Archaeological Salvage. Ms. on file, Chief Joseph Dam Cultural Resources Project.

1978 Chief Joseph Dam Reservoir: results of the 1977 faunal analysis. Ms. on file, U.S. Army Corps of Engineers, Seattle District.

Manville, R.H.

1980 The origin and relationship of American wild sheep. In **The desert bighorn: its life history, ecology and management**, edited by G. Monson and L. Sumner, pp. 1-6. University of Arizona Press, Tucson.

Maser, C., and R.M. Storm

1970 **A Key to the Microtinae of the Pacific Northwest.** Corvallis, Oregon State University Book Stores.

Miss, C.J.

1984a **Archaeological Investigations at Site 45-DO-214, Chief Joseph Dam Reservoir, Washington.** Office of Public Archaeology, University of Washington, Seattle.

1984b **Archaeological Investigations at Site 45-DO-285, Chief Joseph Dam Reservoir, Washington.** Office of Public Archaeology, University of Washington, Seattle.

1984c **Archaeological Investigations at Site 45-OK-250/4, Chief Joseph Dam Reservoir, Washington.** Office of Public Archaeology, University of Washington, Seattle.

1984d **Archaeological investigations at Site 45-OK-287/288, Chief Joseph Dam Reservoir, Washington.** Office of Public Archaeology, University of Washington, Seattle.

Monks, G.C.

1981 Seasonality studies. In **Advances in archaeological theory and methods** (Vol. 4), edited by M.B. Schiffer, pp. 177-240. Academic Press, New York.

Munsell, D.A., and L.V. Salo

1977 **Chief Joseph Dam cultural resources reconnaissance report, Rufus Woods Lake, Columbia River, Washington.** U.S. Army Corps of Engineers, Seattle District.

Muto, G.R.

1971 **A technological analysis of the early stages in the manufacture of lithic artifacts.** Unpublished M.A. thesis, Department of Anthropology, Idaho State University.

1976 The Cascade technique: an examination of a Levallois-like reduction system in early Snake River prehistory. Unpublished Ph.D. dissertation, Department of Anthropology, Washington State University.

Nelson, C.M.

1969 The Sunset Creek site (45-KT-28) and its place in Plateau prehistory. **Washington State Universtiy, Laboratory of Anthropology, Reports of Investigations** 47.

1973 Prehistoric culture change in the intermontane Plateau of western North America. In **The explanation of culture change,** edited by C. Renfrew, pp. 371-390. Duckworth, London.

Nie, N.H., C.H. Hull, J.G. Jenkins, K. Steinbrenner, and D.H. Bent

1975 **SPSS: statistical package for the social sciences** (second ed.). Mcgraw-Hill, New York.

Noe-Nygaard, N.

1977 Butchering and marrow fracturing as a taphonomic factor in archaeological deposits. **Paleobiology** 3:218-237.

Odell, G.H.

1977 **The application of micro-wear analysis to the lithic component of an entire prehistoric settlement: methods, problems and functional reconstructions.** Unpublished Ph.D. dissertation, Department of Anthropology, Harvard University.

Osborne, H.D., R. Crabtree, and A. Bryan

1952 Archaeological investigations in the Chief Joseph Reservoir. **American Antiquity** 17:360-373.

Post, R.H.
1938 The subsistence quest. In The Sinkaietk or Southern Okanogan of Washington, edited by L. Spier, pp. 9-34. **George Banta, General Series in Anthropology** 6.

Piper, C.
1906 Flora of the state of Washington. In **Contributions to the U.S. National Herbarium** (Vol. 11). U.S. Government Printing Office, Washington, D.C.

Potts, R., and P. Shipman
1981 Cutmarks made by stone tools on bones from Olduvai Gorge, Tanzania. **Nature** 291:577-580.

Ray, V.F.
1932 The Sanpoil and Nespelem: Salishan peoples of northeast Washington. **University of Washington, Publications in Anthropology** 5.

Rice, D.G.
1969 Preliminary report, Marmes Rockshelter Archaeological site, Southern Columbia Plateau. Report submitted to the National Park Service, Pullman.

1972 The Windust phase in lower Snake River prehistory. **Washington State University, Laboratory of Anthropology, Reports of Investigations** 50.

1974 **A commentary on the derivation of Plateau cultural.** Report Mid-Columbia Archaeological Society.

Robinette, W.L., D.A. Jones, G. Rogers, and J.S. Gashwiler
1957 Notes on tooth development and wear for Rocky Mountain mule deer. **Journal of Wildlife Management** 21(2):134-153.

Sanger, D.
1968 Prepared core and blade traditions in the Pacific Northwest. **Arctic Anthropology** 5:92-120.

1970 Midlatitude core and blade traditions. **Arctic Anthropology** 7:106-114.

Schalk, R.F.
1978 Some observations on migratory fish in the Plateau. In Second annual interim report on the archaeological investigations at the Miller Site (45FR5) on Strawberry Island (1977), a late prehistoric village near Burbank, Washington, edited by G. C. Cleveland, 61-80. **Washington State University, Washington Archaeological Research Center, Project Report** 72.

Semenov, S.A.
1964 **Prehistoric technology: an experimental study of the oldest tools and artifacts from traces of manufacture and wear** (translated by M.W. Thompson). Cory, Adams & Mackay, London.

Severinghause, C.W.
1949 Tooth development and wear as criteria of age in white-tailed deer. **Journal of Wildlife Management** 13:195-216.

Smith, L., and A. Goodyear
1976 The statistical discrimination of hard and soft percussors. Ms. in hands of authors.

Speth, J.
1972 Mechanical basis of percussion flaking. **American Antiquity** 37:34-60.

Spier, L. (editor)
1938 The Sinkaietk or Southern Okanogan of Washington. **George Banta, General Series in Anthropology** 6.

Spinden, H.
1908 The Nez Perce Indians. **American Anthropological Association, Memoirs** 2:167-274.

Stafford, B.D.
1977 Burin manufacture and utilization; an experimental study. **Journal of Field Archaeology** 4:235-246.

Stafford, B.D., and C.R. Stafford
1979 **A comparison of macro- and microwear functional analyses of lithics.** Paper presented at the 44th Annual Meeting of the Society for American Archaeology, Vancouver, B.C.

Stebbins, R.C.
1966 **A field guide to western reptiles and amphibians.** Houghton Mifflin, Boston.

Swanson, E.H., Jr.
1962 The emergence of Plateau Culture. **Idaho State College Museum, Occasional Papers** 8.

Swanson, E.H., Jr. (editor)
1975 **Lithic technology, making and using stone tools.** Mouton, The Hague.

Szuter, C.R.
1982 **The interpretation of rodent bones from Hohokam sites.** Paper presented at the 47th Annual Meeting of the Society for American Archaeology, Minneapolis.

Thomas, B., M.G. Hawkes, and L.L. Larson
1983 **Archaeological investigations at 30 historic sites, Chief Joseph Dam Reservoir, Washington.** Office of Public Archaeology, University of Washington

Wilmsen, E.N.
1968 Functional analysis of flaked stone artifacts. **American Antiquity** 33:156-161.

1970 Lithic analysis and cultural inference: a paleo-indian case. **University of Arizona, Anthropological Papers** 16.

Wing, E.S., and A.B. Brown

1971 **Paleonutrition: method and theory in prehistoric foodways.** Press, New York.

APPENDIX A:

RADIOCARBON DATE SAMPLES AND RESULTS OF SOIL ANALYSES, 45-DO-211

Table A-1. Radiocarbon date samples, 45-DO-211.

Lab Sample #[1]	Zone	DU	Stratum	Unit	Level	Feature #	Material/gms	Radiocarbon Age (Years.B.P.) T1/2=5730	Dendrocorrected Age[2] (Years.B.P.)
B-2522	4	III	-	56N26W	150	13	Charcoal/5.5	2580±70	2712±86
	3 samples were taken from Housepit 2 floor: NW quad - .8 g; NE quad - 2.1 g; SW quad - 2.6 g								
B-2523	5	IIa	-	55N26W	140	14,24,59	Charcoal/5.2	4760±110	5487±142
	Mixed geologic and cultural deposits. F59 is a small charcoal-stained area, possible use surface.								
TX-4032	5	IIb	-	53N26W	140	30	Charcoal/10	3300±80	3636±100
	Housepit 1 floor. Charcoal recovered immediately above pit (F42) in floor.								
TX-4033	5	IIb	-	55N24W	190	29	Charcoal/9	3200±50	3505±74
	Pit, provenience uncleaer. Either originates in (now destroyed) portion of HP 1 floor, of is bracketed by HP 1 (below) and HP 2 (above).								

1 TX samples were dated by University of Texas-Austin, Radiocarbon Laboratory.
B samples were dated by Beta Analytic, Inc.

2 Dendrocorrected after Damon et al. (1974).

Table A-2. Results of physical and chemical soil analyses, Column 2, 45-DO-211.

Sample No.	cm Below Surface	Color (dry)	Physical Analyses: Particle Size: Sand/Silt/Clay (%)	Physical Analyses: Constituents: Charcoal (%)	Ash (%)	Bone (%)	Shell (%)	Organic Matter (%)	Minerals (%)	Chemical Analyses: Grain Rounding[1]	pH	Organic Matter (%)	Exchangeable Calcium (ppm)	Phosphate (ppm)
1	0-2	10YR 5/3	60/35/5	-	1	Trace	-	7	91+	2	6.8	2.7	4170	38.2
2	5-15	10YR 5/3-6/3	55/32/13	Trace	-	Trace	-	4	95+	2/4	7.5	Trace	1645	44.1
3	20-30	10YR 5/3-6/3	57/30/13	Trace	-	-	Trace	1	98+	2	7.9	-	2870	47.6
4	30-40	10YR 5/3-6/3	60/30/10	Trace	-	-	-	1	98+	2	7.9	-	3150	57.4
5	40-48	10YR 5/3-6/3	60/32/8	Trace	-	-	Trace	1	98+	2	8.0	-	3150	65.1
6	54-64	10YR 6/3	55/35/10	Trace	-	-	-	1	98+	1	8.0	-	1890	53.9
7	64-74	10YR 6/3	57/38/5	Trace	-	-	-	1	98+	1/2	8.2	-	2100	56.7
8	74-84	10YR 6/3	60/32/8	Trace	-	-	-	1	98+	1/2	8.4	-	1470	51.8
9	84-90	10YR 6/3	60/35/5	-	-	-	-	1	98	1/2	8.5	-	2100	52.5
10	93-103	10YR 6/3-7/2	55/37/8	Trace	-	-	-	Trace	99	1	8.7	-	4480	51.1
11	109-119	10YR 7/2	52/38/10	Trace	-	-	-	Trace	99	2/4	8.9	-	5600	25.2
12	119-129	10YR 7/2	50/42/8	Trace	-	-	-	Trace	99	2/4	9.3	-	4480	11.2
13	129-139	10YR 7/2	62/33/5	-	-	-	-	Trace	99+	2/4	9.2	-	4620	12.8
14	144-152	10YR 7/2-6/2	60/35/5	Trace	-	-	-	Trace	98	2	9.5	-	3255	21.0
15	160-170	10YR 7/2-6/2	65/32/3	Trace	-	-	-	-	99+	1/4	9.5	-	3150	32.9
16	174-184	10YR 6/3	62/33/5	Trace	-	-	-	Trace	99	2	9.5	-	2905	43.4
17	191-201	10YR 6/3	72/25/3	-	-	Trace	-	-	99+	2	9.7	-	2590	58.1
18	201-211	10YR 6/3	72/25/3	Trace	-	-	-	1	98+	2	9.8	-	2450	53.2
19	216-226	10YR 6/3	90/10/-	-	-	-	-	Trace	99+	4/1/2	10.1	-	2870	43.4

[1] 1=angular, 2=sub-angular, 3=rounded, 4=sub-rounded.

Table A-3. Results of physical and chemical soil analyses, Column 3, 45-DO-211.

Sample No.	cm Below Surface	Color (dry)	Physical Analyses: Particle Size: Sand/Silt/Clay (%)	Physical Analyses: Constituents: Charcoal (%)	Ash (%)	Bone (%)	Shell (%)	Organic Matter (%)	Minerals (%)	Chemical Analyses: Grain Rounding[1]	pH	Organic Matter (%)	Exchangeable Calcium (ppm)	Phosphate (ppm)
1	0-3	10YR 5/3	72/20/8	Trace	-	-	-	4	95+	1/2	6.85	Trace	1330	51.1
2	6-16	10YR 5/3	72/20/8	Trace	-	-	-	1	98+	1/2	7.35	Trace	928	61.1
3	16-22	10YR 5/3	70/22/8	Trace	-	-	-	Trace	99	1/2	7.55	Trace	378	48.7
4	25-35	10YR 5/2	70/25/5	Trace	-	-	-	Trace	99	2	7.65	-	926	55.9
5	35-45	10YR 5/2	72/20/8	Trace	-	-	-	Trace	99	2	7.65	-	1400	51.1
6	45-55	10YR 5/2	67/25/8	Trace	-	-	-	Trace	99	1/2	7.70	-	1330	55.7
7	59-69	10YR 6/2	72/20/8	-	-	-	Trace	Trace	99	2	7.95	-	626	56.7
8	69-77	10YR 6/2	72/20/8	Trace	-	Trace	Trace	Trace	99	1/2	7.95	-	2119	59.5
9	81-91	10YR 6/2-7/2	70/20/10	Trace	-	Trace	Trace	Trace	99	2	8.05	-	2821	63.0
10	91-100	10YR 6/2-7/2	70/22/8	-	-	Trace	Trace	Trace	99	1/2	8.10	-	2821	37.9
11	105-115	10YR 6/3	70/22/8	Trace	-	-	3	-	96+	2	8.20	-	2821	38.5
12	115-125	10YR 6/3	70/22/8	Trace	-	-	2	Trace	97+	2	8.20	-	2821	42.0
13	125-131	10YR 6/3	70/20/10	Trace	-	-	5	Trace	94+	1/2	8.20	-	2821	41.3
14	137-140	10YR 6/3	72/20/8	Trace	-	-	1	Trace	98+	1/2	8.15	-	2821	32.8
15	143-147	10YR 6/3	77/15/8	-	-	-	Trace	Trace	99	1/2	8.20	-	2779	30.1
16	150-160	10YR 6/3	82/10/8	-	-	-	-	Trace	99+	1/2	8.10	-	2779	41.3

[1] 1=angular, 2=sub-angular, 3=rounded, 4=sub-rounded.

Table A-4. Results of physical and chemical soil analyses, Column 4, 45-DO-211.

Sample No.	cm Below Surface	Color (dry)	Physical Analyses: Particle Size: Sand/Silt/Clay (%)	Physical Analyses: Constituents: Charcoal (%)	Ash (%)	Bone (%)	Shell (%)	Organic Matter (%)	Minerals (%)	Chemical Analyses: Grain Rounding[1]	pH	Organic Matter (%)	Exchangeable Calcium (ppm)	Phosphate (ppm)
1	32-38	10YR 5/3	67/28/5	1	-	-	-	10	89	1/2	7.15	Trace	1400	58.6
2	44-50	10YR 5/3	70/25/5	Trace	-	Trace	-	3	96+	1/2	7.80	Trace	1225	67.9
3	58-66	10YR 5/3	70/22/8	Trace	-	-	-	2	97+	2	7.80	-	1719	70.7
4	66-76	10YR 5/3	72/20/8	Trace	-	-	-	1	98+	2	7.75	-	1645	72.1
5	80-90	10YR 5/3	70/22/8	-	-	-	-	Trace	99+	1/2	7.65	-	1645	70.7
6	90-100	10YR 5/3	70/22/8	Trace	-	-	-	Trace	99	1/2	7.70	-	2464	74.9
7	108-118	10YR 6/3	67/25/8	Trace	Trace	-	-	Trace	99	1/2	7.70	-	1540	68.6
8	124-132	10YR 5.5/3	67/25/8	Trace	-	-	-	Trace	99	1/2	7.75	-	2118	64.4
9	136-144	10YR 6/4	75/17/8	Trace	-	Trace	-	Trace	99	1/2	7.80	-	756	70.7
10	146-150	10YR 7/3	72/18/10	Trace	-	-	-	Trace	99	1/2	7.90	-	625	64.4
11	150-154	10YR 6/3	72/20/8	Trace	-	-	1	Trace	98+	2/4	7.90	-	2779	65.1
12	156-160	10YR 4/1	75/17/8	1	-	Trace	Trace	Trace	98+	1/2	8.00	Trace	2779	76.3
13	160-164	10YR 5.5/3	82/13/5	Trace	-	-	-	Trace	99	1/2	8.00	-	378	67.9
14	166-170	10YR 6/6	82/10/8	Trace	-	-	-	Trace	99	2/4	8.10	-	2380	63.7
15[2]	42-48	10YR 5/4	70/22/8	Trace	-	Trace	-	3	96+	1/2	7.65	Trace	1024	70.0
16[2]	134-140	10YR 6/3	72/20/8	1	-	Trace	-	Trace	98+	1/2	8.05	Trace	2023	76.3

[1] 1=angular, 2=sub-angular, 3=rounded, 4=sub-rounded.
[2] Off column.

Table A-5. Results of physical and chemical soil analyses, Column 5, 45-DO-211.

Sample No.	cm Below Surface	Color (dry)	Physical Analyses							Chemical Analyses				
			Particle Size	Constituents						Grain Rounding[1]	pH	Organic Matter (%)	Exchangeable Calcium (ppm)	Phosphate (ppm)
			Sand/Silt/Clay (%)	Charcoal (%)	Ash (%)	Bone (%)	Shell (%)	Organic Matter (%)	Minerals (%)					
1	0-4	10YR 5/3	55/35/10	Trace	-	-	-	6	93+	1/2	6.65	Trace	-	67.2
2	7-17	10YR 5/2	52/38/10	Trace	-	Trace	-	1	98+	2	6.90	Trace	-	66.5
3	20-30	10YR 5/3	60/30/10	Trace	-	-	-	Trace	99	1/2	7.20	-	-	67.2
4	30-40	10YR 5/3	60/32/8	-	-	-	-	Trace	99+	1/2	7.40	-	-	67.2
5	44-54	10YR 5/3	60/32/8	-	-	Trace	-	Trace	99	1/2	7.15	-	-	67.9
6	54-64	10YR 5/3	62/30/8	-	-	-	-	Trace	99+	1/2	7.10	-	-	68.5
7	64-73	10YR 5/3	62/30/8	Trace	-	-	-	Trace	99	1/2	7.15	-	-	67.2
8	78-88	10YR 6/2	62/30/8	Trace	-	Trace	-	Trace	99	1/2	7.20	-	293	70.0
9	88-98	10YR 6/2	62/30/8	-	-	-	-	Trace	99+	2	7.40	-	-	73.5
10	98-108	10YR 6/2	60/32/8	Trace	-	-	-	Trace	99	2	7.50	-	293	70.0
11	110-120	10YR 6/2	62/28/10	Trace	-	-	-	Trace	99	1/2	7.60	-	625	72.1
12	120-128	10YR 6/2	60/32/8	Trace	-	-	-	-	99+	1/2	7.65	-	293	64.4
13	130-138	10YR 6/3	60/30/10	Trace	-	-	-	Trace	99	1/2	7.65	-	625	66.5
14	139-145	10YR 4/2-7.5YR 5/4	62/25/13	Trace	-	-	-	Trace	99	1/2	7.70	-	1400	61.2
15	145-149	10YR 4/2-7.5YR 5/4	60/30/10	Trace	-	-	-	-	99+	2	7.80	-	378	72.1
16	152-156	10YR 6/3	75/22/3	-	-	-	-	-	100	2	7.90	-	-	62.3
17	157-160	10YR 6/3	72/23/5	-	-	-	-	-	100	1/2	8.05	-	-	65.1
18	162-171	Salt/Pepper	85/15/-	-	-	-	-	-	100	1/2	8.20	-	-	53.9
19	171-181	Salt/Pepper	95/2/3	-	-	-	-	-	100	1/2	8.30	-	-	51.1
20	186-190	Too Coarse	90/7/3	-	-	-	-	-	100	1/2	8.40	-	-	49.7

[1] 1=angular, 2=sub-angular, 3=rounded, 4=sub-rounded.

Table A-6. Results of physical and chemical soil analyses, Column 6, 45-DO-211.

Sample No.	cm Below Surface	Color (dry)	Physical Analyses: Particle Size								Chemical Analyses			
			Particle Size	Constituents						Grain Rounding[1]	pH	Organic Matter (%)	Exchangeable Calcium (ppm)	Phosphate (ppm)
			Sand/Silt/Clay (%)	Charcoal (%)	Ash (%)	Bone (%)	Shell (%)	Organic Matter (%)	Minerals (%)					
1	5-13	10YR 5/2	65/32/3	Trace	-	-	-	-	99+	1/2	7.4	-	4620	60.9
2	21-31	10YR 6/2	65/30/5	1	-	-	-	Trace	99+	1/2	7.5	Trace	2310	48.3
3	51-61	10YR 6/3	67/28/5	Trace	-	-	-	Trace	99	2	7.8	-	3500	59.8
4	101-111	10YR 5/3	72/25/3	Trace	-	-	-	Trace	99	2/4	8.4	-	2905	49.0
5	125-129	10YR 6/3	67/30/3	5	-	Trace	-	Trace	94+	2	8.6	-	3430	85.1
6	131-137	10YR 6/3	72/25/3	3	-	-	-	Trace	96+	2	8.7	-	1575	79.1
7	141-151	10YR 6/3	72/25/3	3	-	-	-	Trace	96+	2	8.8	-	469	77.0
8	151-159	10YR 6/3	67/30/3	Trace	-	-	-	Trace	99	2	8.8	-	595	74.9
9	167-177	10YR 6/2	87/10/3	Trace	-	-	-	-	99+	2	8.9	-	2590	64.4
10[2]	135-141	10YR 6/3	72/23/5	-	-	-	-	Trace	99+	2	8.8	-	616	79.1
11[2]	147-157	10YR 6/2	90/5/5	Trace	-	-	-	Trace	99	2	8.9	-	1890	58.1
12[2]	161-171	10YR 6/3	62/35/3	-	-	-	-	Trace	99+	2	8.9	-	469	79.1
13[2]	116-126	10YR 6/3-7/2	72/25/3	-	-	-	-	Trace	99+	1/2	8.5	-	2905	61.9

[1] 1=angular, 2=sub-angular, 3=rounded, 4=sub-rounded.
[2] Off column.

Table A-7. Results of physical and chemical soil analyses, Column 7, 45-DO-211.

Sample No.	cm Below Surface	Color (dry)	Physical Analyses								Chemical Analyses			
			Particle Size	Constituents						Grain Rounding[1]	pH	Organic Matter (%)	Exchangeable Calcium (ppm)	Phosphate (ppm)
			Sand/Silt/Clay (%)	Charcoal (%)	Ash (%)	Bone (%)	Shell (%)	Organic Matter (%)	Minerals (%)					
1	95-105	10YR 6/2-7/2	70/25/5	Trace	-	-	-	Trace	99	2	8.20	-	2852.5	25.2
2	105-115	10YR 6/2-7/2	72/23/5	-	-	-	-	Trace	99+	1/2	8.40	-	2852.5	10.5
3	120-130	10YR 6/3	77/20/3	-	-	Trace	-	Trace	99	1/2	8.55	-	2779.0	38.5
4	134-142	10YR 6/2-5/2	90/10/-	Trace	-	-	-	Trace	99	1/2	8.70	-	2118	50.4
5	144-150	10YR 6/3	85/12/3	Trace	-	-	-	-	99+	1/2	8.70	-	1300	50.4
6	152-162	Salt and Pepper	90/10/-	-	-	-	-	-	100	1/2	8.80	-	-	45.5

[1] 1=angular, 2=sub-angular, 3=rounded, 4=sub-rounded.

Table A-8. Results of physical and chemical soil analyses, Column 7a, 45-DO-211.

Sample No.	cm Below Surface	Color (dry)	Physical Analyses							Chemical Analyses				
			Particle Size	Constituents						Grain Rounding[1]	pH	Organic Matter (%)	Exchangeable Calcium (ppm)	Phosphate (ppm)
			Sand/Silt/Clay (%)	Charcoal (%)	Ash (%)	Bone (%)	Shell (%)	Organic Matter (%)	Minerals (%)					
1	80-90	10YR 6/2-7/2	60/37/3	-	-	-	-	1	99	1/2	8.3	-	2821.0	7.0
2	110-120	10YR 6/2	65/32/3	-	-	-	-	Trace	99+	1/2	8.3	-	2821.0	25.9
3	135-145	10YR 6/2	70/27/3	Trace	-	-	-	Trace	99	1/2	8.65	-	2821.0	32.2
4	140-150	10YR 7/1	72/25/3	Trace	-	-	Trace	Trace	99	1/2	8.5	-	2779.0	46.2

[1] 1=angular, 2=sub-angular, 3=rounded, 4=sub-rounded.

APPENDIX B:

ARTIFACT ASSEMBLAGE, 45-DO-211

Table B-1. Functional type by object edge angle by zone, 45-DO-211.

Functional type by Zone	Edge angle (degrees)																						Total[1]
	1-5	6-10	11-15	16-20	21-25	26-30	31-35	36-40	41-45	46-50	51-55	56-60	61-65	66-70	71-75	76-80	81-85	86-90	91-95	>95	Surface	Misc.	
Projectile point																							
2	-	-	-	-	-	-	-	-	-	1	-	-	-	-	-	-	-	-	-	-	-	-	1
3	-	-	-	-	-	-	-	-	1	-	1	-	-	-	-	1	-	-	-	-	-	-	3
3:HP2 Fill	-	-	-	-	-	-	-	-	-	-	-	1	-	-	-	-	-	-	-	-	-	-	1
Total	-	-	-	-	-	-	-	-	1	1	1	1	-	-	-	1	-	-	-	-	-	-	5
Projectile point base																							
1	-	-	-	-	-	-	-	-	-	-	1	-	-	-	-	-	-	-	-	-	-	-	1
Projectile point tip																							
4:HP2 Floor	-	-	-	-	-	-	-	-	-	-	-	-	1	-	-	-	-	-	-	-	-	-	1
Unassigned	-	-	-	-	-	-	-	2	-	-	1	-	-	-	-	-	-	-	-	-	-	-	3
Total	-	-	-	-	-	-	-	2	-	-	1	-	1	-	-	-	-	-	-	-	-	-	4
Biface																							
1	-	-	-	-	-	-	-	-	-	1	-	-	1	-	-	-	-	-	-	-	-	-	2
2	-	-	-	-	-	-	-	-	1	1	-	-	-	-	-	-	-	-	-	-	-	-	2
3	-	1	-	-	-	-	-	-	-	1	-	1	-	-	-	-	-	-	-	-	-	-	3
4	-	-	-	-	-	-	-	-	2	-	-	-	-	-	-	-	-	-	-	-	-	-	2
4:HP2 Floor	-	-	-	-	-	-	-	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1
Total	-	1	-	-	-	-	-	1	3	3	-	1	1	-	-	-	-	-	-	-	-	-	10
Chopper																							
5	-	-	-	-	-	-	-	-	-	-	-	-	-	1	-	-	-	-	-	-	-	-	1
Unassigned	-	-	-	-	-	-	-	-	-	-	-	-	1	-	-	1	-	-	-	-	-	-	2
Total	-	-	-	-	-	-	-	-	-	-	-	-	1	1	-	1	-	-	-	-	-	-	3
Peripherally flaked cobble																							
5	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	2	-	-	-	-	2
4:HP2 Floor	-	-	-	-	-	-	-	-	-	-	-	-	1	-	-	-	-	-	-	-	-	-	1
Total	-	-	-	-	-	-	-	-	-	-	-	-	1	-	-	-	-	2	-	-	-	-	3
Scraper																							
1	-	-	-	-	-	-	-	1	-	-	2	-	-	-	-	-	-	-	-	-	-	-	3
2	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1	-	-	-	-	-	-	1
Unassigned	-	-	-	-	-	-	-	1	-	2	-	-	-	-	-	-	-	-	-	-	-	-	3
Total	-	-	-	-	-	-	-	2	-	2	2	-	-	-	-	1	-	-	-	-	-	-	7
Tabular knife																							
1	-	-	-	-	1	-	1	-	-	-	-	1	-	-	-	-	-	-	-	-	-	-	3
2	-	-	-	2	1	2	-	1	1	1	-	-	1	-	-	-	-	-	-	-	-	-	9
3	-	-	-	1	-	1	1	-	2	-	1	-	-	-	-	-	-	-	-	-	-	-	6
4	-	-	-	-	-	2	1	3	-	1	1	-	-	-	-	-	-	-	-	-	-	-	8
5	-	-	-	-	-	-	-	-	-	-	1	2	-	1	-	-	-	-	-	-	-	-	4
4:HP2 Floor	-	-	-	-	1	3	-	-	1	1	1	2	-	-	-	-	-	-	-	-	-	-	9
Unassigned	-	-	-	-	-	-	-	-	1	1	-	-	-	-	-	-	-	-	-	-	-	-	2
Total	-	-	-	3	3	8	3	4	5	4	4	5	1	1	-	-	-	-	-	-	-	-	41
Anvil																							
2	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1	-	1

Table B-1. Cont'd.

Functional type by Zone	Edge angle (degrees)																						Total
	1-5	6-10	11-15	16-20	21-25	26-30	31-35	36-40	41-45	46-50	51-55	56-60	61-65	66-70	71-75	76-80	81-85	86-90	91-95	>95	Surface	Misc.	
Hammerstone																							
2	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	2	-	2
Unassigned	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	2	-	2
Total	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	4	-	4
Milling stone																							
3	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1	-	1
3:HP2 Fill	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1	-	1
Total	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	2	-	2
Linear flake																							
3	-	-	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1
Core																							
5	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	2	-	-	2
4:HP2 Floor	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1	-	-	1
Total	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	3	-	-	3
Resharpened flake																							
2	-	-	-	-	-	-	-	-	-	1	-	-	-	-	-	1	-	-	-	-	-	-	2
Bifacially retouched flake																							
1	-	-	-	-	-	1	-	1	1	1	-	-	-	-	-	-	-	-	-	-	-	1	5
3	-	-	-	-	-	-	-	-	2	-	-	-	-	-	-	-	-	-	-	-	-	-	2
4	-	-	-	-	-	1	-	-	-	1	-	-	-	-	-	-	-	-	-	-	-	-	2
5	-	-	-	-	-	-	1	1	1	-	1	-	-	-	-	-	-	1	-	-	-	-	5
3:HP2 Fill	-	-	-	-	-	-	-	-	1	2	-	-	-	-	-	-	-	-	-	-	-	-	3
4:HP2 Floor	-	-	-	-	-	1	-	-	1	-	-	-	-	-	-	-	-	-	-	-	-	-	2
Total	-	-	-	-	-	3	1	2	6	4	1	-	-	-	-	-	-	1	-	-	-	1	19
Unifacially retouched flake																							
1	-	-	-	-	-	1	-	-	1	2	2	-	-	-	-	-	-	-	-	-	-	-	6
2	-	-	-	-	2	-	-	1	1	1	1	4	1	1	1	-	-	-	-	-	-	-	13
3	-	-	-	-	-	-	-	-	3	2	-	1	1	-	-	-	-	-	-	-	-	-	7
4	-	-	-	-	-	-	2	2	3	1	2	-	1	-	1	1	1	-	-	-	-	-	14
5	-	-	-	-	-	-	-	-	-	1	1	-	-	-	-	-	-	-	-	-	-	-	2
4:HP2 Floor	-	-	-	-	-	1	1	1	2	1	1	-	-	1	-	-	-	-	-	-	-	-	8
Unassigned	-	-	1	-	-	-	-	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	2
Total	-	-	1	-	2	2	3	5	10	8	7	5	3	2	2	1	1	-	-	-	-	-	48
Utilization only																							
1	1	1	4	1	1	1	1	1	1	-	1	3	-	2	-	-	-	-	-	-	-	-	18
2	-	1	1	6	3	3	5	1	2	3	3	-	1	-	-	-	1	-	-	-	-	-	30
3	-	-	2	2	4	5	3	1	2	1	2	-	1	-	1	-	1	1	-	-	-	-	25
4	-	1	1	3	3	3	3	1	2	3	-	1	1	2	-	-	1	-	-	-	-	-	25
5	-	1	1	2	3	2	4	3	2	1	2	2	3	2	1	-	-	-	1	1	-	-	31
3:HP2 Fill	1	-	1	5	-	2	2	3	2	-	-	-	-	-	-	-	-	-	-	1	-	-	17
4:HP2 Floor	-	-	-	2	-	-	-	2	-	-	-	-	-	-	-	-	-	-	-	-	-	-	4
Unassigned	-	-	-	-	-	-	1	-	-	-	1	-	-	1	-	-	-	-	-	-	-	-	3
Total	2	4	10	21	14	14	19	12	11	8	9	6	6	7	2	-	3	1	1	2	-	-	153
Indeterminate																							
2	-	-	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1
3:HP2 Fill	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1	-	1
Total	-	-	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	2
TOTAL	2	4	13	25	19	29	28	29	36	32	25	18	14	11	2	6	4	4	2	5	8	1	314

1 Non-lithic materials deleted.

Table B-2. Functional type by object edge angle, 45-DO-211.

Functional type	Edge angle (degrees)																				Surface	Misc.	Total[1]
	1-5	6-10	11-15	16-20	21-25	26-30	31-35	36-40	41-45	46-50	51-55	56-60	61-65	66-70	71-75	76-80	81-85	86-90	91-95	>95			
Projectile point	-	-	-	-	-	-	-	-	1	1	1	1	-	-	-	1	-	-	-	-	-	-	5
Projectile point base	-	-	-	-	-	-	-	-	-	-	1	-	-	-	-	-	-	-	-	-	-	-	1
Projectile point tip	-	-	-	-	-	-	-	2	-	-	1	-	1	-	-	-	-	-	-	-	-	-	4
Biface	-	-	-	1	-	-	-	1	3	3	-	1	1	-	-	-	-	-	-	-	-	-	10
Chopper	-	-	-	-	-	-	-	-	-	-	-	-	1	1	-	1	-	-	-	-	-	-	3
Peripherally flaked cobble	-	-	-	-	-	-	-	-	-	-	-	-	1	-	-	-	-	2	-	-	-	-	3
Scraper	-	-	-	-	-	-	-	2	-	2	2	-	-	-	-	1	-	-	-	-	-	-	7
Tabular knife	-	-	-	3	3	8	3	4	5	5	3	5	1	1	-	-	-	-	-	-	-	-	41
Anvil	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1	-	1
Hammerstone	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	4	-	4
Milling stone	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	2	-	2
Linear flake	-	-	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1
Core	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	3	-	-	3
Resharpened flake	-	-	-	-	-	-	-	-	-	1	-	-	-	-	-	1	-	-	-	-	-	-	2
Bifacially retouched flake	-	-	-	-	-	3	1	2	6	4	1	-	-	-	-	-	-	1	-	-	-	1	19
Unifacially retouched flake	-	-	1	-	2	2	3	5	10	8	7	5	3	2	1	2	1	-	-	-	-	-	52
Utilization only	2	4	10	21	14	16	19	12	11	8	9	6	6	7	1	-	3	1	1	2	-	-	153
Indeterminate	-	-	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1	-	1	-	3
TOTAL	2	4	13	25	19	29	26	28	36	32	25	18	14	11	2	6	4	4	2	5	8	1	314

[1] Non-lithic materials deleted.

Table B-3. Utilization/modification by object edge angle, 45-DO-211.

	Edge angle (degrees)																				Surface	Misc.	Total[1]
	1-5	6-10	11-15	16-20	21-25	26-30	31-35	36-40	41-45	46-50	51-55	56-60	61-65	66-70	71-75	76-80	81-85	86-90	91-95	>95			
Wear only	2	4	11	21	14	17	20	12	12	9	9	6	7	7	1	-	3	1	1	5	7	-	169
Wear and manufacture	-	-	1	4	5	12	6	16	24	23	16	12	7	4	1	6	1	3	-	-	1	1	143
Modification indeterminate	-	-	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1	-	-	-	2
TOTAL	2	4	13	25	19	29	26	28	36	32	25	18	14	11	2	6	4	4	2	5	8	1	314

[1] Non-lithic materials deleted.

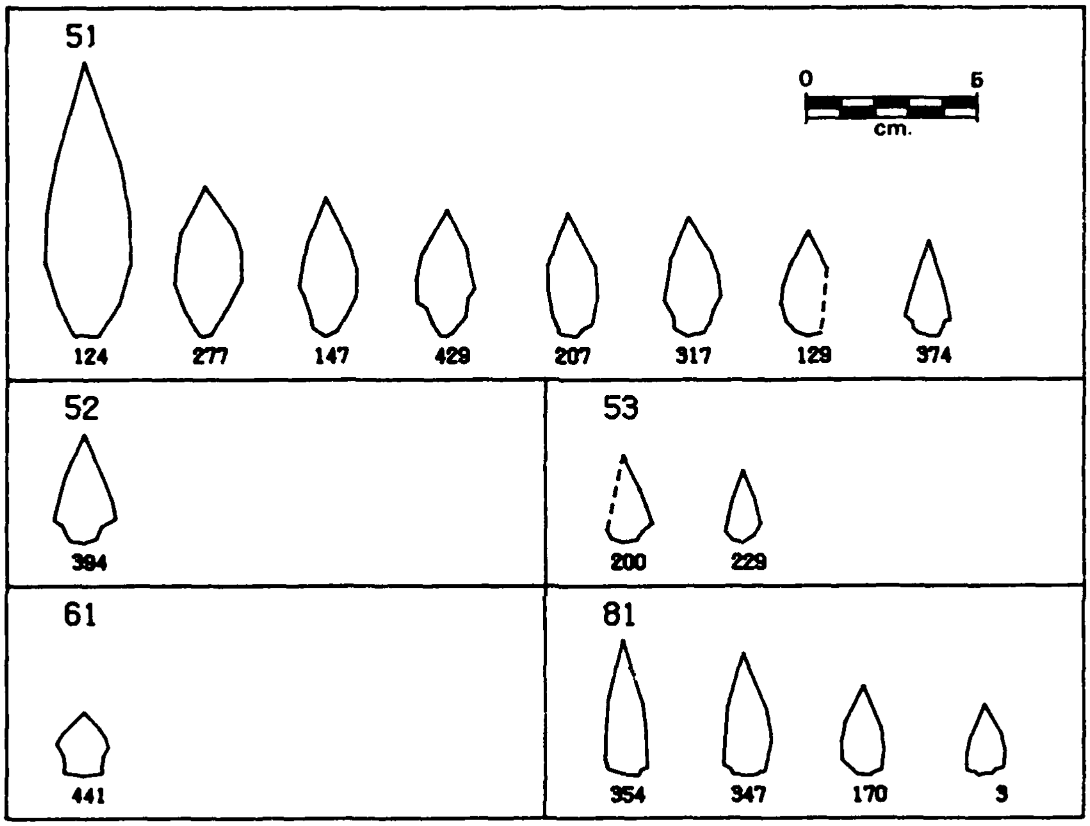


Figure B-1. Digitized projectile point outlines, 45-DO-211.

APPENDIX C:

FAUNAL ASSEMBLAGE, 45-DO-211

Family Soricidae

Sorex sp.

Zone 5: 1 mandible.

Family Leporidae

Zone 1: 1 metapodial fragment

Lepus cf. *townsendii*

Zone 3: 1 femur fragment.
Zone 4:1 scapula fragment.

Sylvilagus sp.

Zone 5: 2 femur fragments.

Family Sciuridae

Marmota flaviventris

Zone 2: 1 astragalus
Zone 3: 2 mandible fragments, 1 maxilla fragment, 1 molariform, 1 femur fragment, 1 tibia fragment, 2 astragali.
Zone 4: 1 mandible, 1 maxilla fragment, 1 humerus fragment, 1 ulna fragment, 1 tibia fragment, 1 astragalus, 1 calcaneum.
Zone 5: 1 mandible, 1 mandible fragment, 1 radius fragment, 1 ulna fragment, 1 femur fragment.
Zone 3:HP2 Fill: 3 mandible fragments
Zone 4:HP2 Floor: 1 astragalus

Spermophilus sp.

Zone 2: 4 mandible fragments
Zone 3: 2 mandible fragments, 2 humerus fragments

Zone 4: 1 maxilla fragment
Zone 5: 2 maxilla fragments, 1 humerus fragment
Zone 4:HP2 Floor: 1 humerus fragment

Family Geomyidae

Thomomys talpoides

Zone 1: 2 mandible fragments, 1 maxilla fragment, 1 humerus, 1 humerus fragment.
Zone 2: 12 mandible fragments, 4 mandibles, 1 skull, 9 maxilla fragments, 1 humerus, 1 ulna, 2 scapulae, 4 innominate fragments, 3 femora, 3 femur fragments, 3 tibiae, 4 tibia fragments.
Zone 3: 4 skulls, 7 mandibles, 9 mandible fragments, 10 maxilla fragments, 3 scapulae, 4 humerii, 3 humerus fragments, 1 radius fragment, 3 ulnae, 4 innominate fragments, 12 femora, 3 femur fragments, 5 tibiae.
Zone 4: 4 skulls, 8 mandibles, 23 mandible fragments, 5 maxilla fragments, 6 scapulae, 6 humerii, 3 humerus fragmens, 3 radii, 2 ulnae, 1 ulna fragment, 1 sacrum, 2 innominates, 4 innominate fragments, 2 femora, 9 femur fragments, 7 tibiae, 4 tibia fragments.
Zone 5: 3 skulls, 6 mandibles, 15 mandible fragments, 12 maxilla fragments, 3 humerii, 4 humerus fragments, 1 radius, 1 radius fragment, 1 ulna, 3 innominate fragments, 3 femora, 2 femur fragments, 2 tibiae, 2 tibia fragments.
Zone 3:HP2 Fill: 1 mandible fragment, 1 scapula, 1 humerus fragment, 1 femur.
Zone 4:HP2 Floor: 1 mandible, 3 mandible fragments, 2 maxilla fragments.

Family Heteromyidae

Perognathus parvus

Zone 1: 1 maxilla fragment.
Zone 2: 2 mandibles, 5 mandible fragments, 2 maxilla fragments, 1 innominate, 3 femora, 1 tibia.
Zone 3: 4 mandibles, 4 mandible fragments, 3 maxillae, 1 skull, 2 femora, 1 femur fragment.
Zone 4: 3 mandibles, 1 mandible fragment, 2 maxilla fragments, 2 femora, 1 tibia.
Zone 5: 2 mandible fragments, 2 maxilla fragments, 1 femur fragment, 1 tibia.
Zone 3:HP2 Fill: 3 mandible fragments, 1 humerus fragment, 1 femur.
Zone 4:HP2 Floor: 1 mandible.

Family Cricetidae

Zone 1: 1 skull fragment, 2 maxilla fragments.
Zone 2: 4 mandible fragments, 1 maxilla fragment.

Zone 3: 3 mandible fragments, 2 maxilla fragments.
Zone 4: 1 mandible fragment.
Zone 5: 1 mandible fragment, 1 femur.
Zone 4:HP2 Floor: 2 mandible fragments.

Peromyscus maniculatus

Zone 2: 1 mandible.
Zone 4: 2 mandible fragments

Microtus sp.

Zone 2: 1 skull, 1 maxilla fragment, 4 mandible fragments, 1 femur.
Zone 3: 1 maxilla fragment.
Zone 5: 1 mandible fragment.
Zone 3:HP2 Fill: 1 mandible.

Lagurus curtatus

Zone 1: 1 mandible, 3 mandible fragments.
Zone 2: 2 skulls, 2 mandibles, 12 mandible fragments.
Zone 3: 2 mandibles, 7 mandible fragments.
Zone 4: 2 mandibles, 4 mandible fragments.
Zone 5: 4 mandible fragments.

Family Canidae

Canis sp.

Zone 2: 1 lower incisor.
Zone 5: 1 lower incisor.

Canis cf. latrans

Zone 4: 1 second phalanx.

Family Mustelidae

Mustela frenata

Zone 5: 1 skull, 2 mandibles.

Taxidea taxus

Zone 3:HP2 Fill: 1 lower molar fragment.

Family Cervidae

Zone 2: antler fragment.
Zone 5: antler.

Odocoileus sp.

Zone 2: 1 incisor fragment, 3 premolars, 1 maxilla fragment, metapodial fragment.
Zone 3: 1 premolar, 3 molariform fragments, 1 mandible fragment.
Zone 4: 1 skull fragment, 1 innominate fragment.
Zone 5: 1 molariform fragment, 1 second phalanx fragment.
Zone 3:HP2 Fill: 1 premolar, 1 molar, 15 molariform fragments.
Zone 4:HP2 Floor: 2 incisors, 5 molariform fragments, 1 scapula fragment, 1 calcaneum fragment, 1 metatarsal fragment.

Deer-Sized

Zone 2: 1 skull fragment, 1 innominate fragment.
Zone 3: 1 ulna fragment, 1 astragalus fragment, 2 rib fragments.
Zone 4: 1 mandible fragment, 1 premaxilla fragment, 1 humerus fragment, 1 lumbar vertebra fragment, 2 rib fragments, 2 innominate fragments, 1 femur fragment, 1 tibia fragment.
Zone 5: 3 rib fragments, 1 tibia fragment, 1 metatarsal fragment.
Zone 3:HP2 Fill: 1 tibia fragment.
Zone 4:HP2 Floor: 1 premaxilla fragment, 3 humerus fragments, 1 radius fragment, 1 ulna fragment, 1 lumbar vertebra fragment, 1 rib fragment, 1 femur fragment, 5 tibia fragments, 2 metatarsal fragments.

Family Bovidae

Ovis canadensis

Zone 2: 1 incisor

Family Hominidae

Homo sapiens

Zone 4: 1 humerus fragment.

Family Chelydridae

Chrysemys picta

Zone 2: 4 shell fragments.
Zone 3: 10 shell fragments.
Zone 4: 3 shell fragments.

Zone 5: 6 shell fragments.
Zone 3:HP2 Fill: 3 shell fragments.
Zone 4:HP2 Floor: 1 shell fragment.

Family Colubridae

Zone 3: 7 vertebrae.
Zone 4: 24 vertebrae.
Zone 5: 5 vertebrae.

Family Viperidae

Crotalus viridis

Zone 2: 1 vertebra.

Family Ranidae/Bufonidae

Zone 3: 1 tibiofibula
Zone 4: 1 tibiofibula
Zone 5: 2 maxillae, 2 scapulae, 2 humerii, 1 radio-ulna, 2 ilia, 4 tibiofibulae.

Family Salmonidae

Zone 1: 1 vertebra fragment.
Zone 2: 32 vertebrae and vertebra fragments.
Zone 3: 125 vertebrae and vertebra fragments.
Zone 4: 851 vertebrae and vertebra fragments.
Zone 5: 10 vertebrae and vertebra fragments.
Zone 3:HP2 Fill: 1 vertebra fragment.

Oncorhynchus tshawytscha

Zone 1: 1 otolith.
Zone 2: 1 otolith.
Zone 4: 7 otoliths.
Zone 5: 1 otolith.

Family Cyprinidae

Zone 2: 1 vertebra.
Zone 4: 1 vertebra.

Family Catostomidae

Zone 4: 7 vertebrae.

APPENDIX D:

DESCRIPTION OF CONTENTS OF UNCIRCULATED APPENDICES

Detailed data from two different analyses are available in the form of hard copies of computer files with accompanying coding keys.

Functional analysis data include provenience (site, analytic zone, excavation unit and level, and feature number and level (if applicable)); object master number; abbreviated functional object type; and coding that describes each tool on a given object. Data normally are displayed in alphanumeric order by site, analytic zone, functional object type, and master number. Different formats nay be available upon request depending upon research focus.

Faunal analysis data include provenience (site, analytic zone, excavation unit and level, feature number, and level (if applicable)); taxonomy (family; genus, species); skeletal element; condition code; side; sex; burning/butchering code; quantity; and age. Data normally are displayed in alphanumeric order by site, analytic zone, provenience, taxonomy, etc.

To obtain copies of the uncirculated appendices contact U.S. Army Corps of Engineers, Seattle District, Post Office Box C-3755, Seattle, Washington, 98124. Copies also are being sent to regional archives and libraries.

END

FILMED

2-86

DTIC